the OIL AND GAS JOURNAL

MARCH 16, 1959

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the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
March 16, 1959

New imports plan means some sweeping changes for oil industry:

The mandatory controls will cut total imports by about 270,000 bbl. daily or 15% below their 1958 levels (p. 69).

Both crude and products are covered. Greatest cut goes to imports of finished products.

Allowed imports now will total about 1,415,000 bbl. daily. Average last year was about 1,685,000 bbl. daily. Refiners and marketers, however, imported a record 2,616,800 bbl. daily last week to get under the wire before new quotas were applied.

More than 100 companies are prospective importers under new plan compared with only 40 under voluntary program.

Individual quotas will be based on refinery runs at a certain base period in 1958. But a refiner's quota will not be cut more than 20% below his allocation under the old plan.

▼ ▼ ▼

Congressional pressure is increasing for review of 27½% depletion.

Majority report issued last week by Joint Economic Committee claims "entire subject needs further specific attention." Committee is headed by Sen. Paul H. Douglas, Illinois Democrat.

Even Republican minority report made by Sen. Jacob K. Javits of New York favors "reasonable reduction in depletion allowance and other special tax privileges" revealing ignorance of principles underlying depletion.

Whole issue may be considered sooner than expected short time ago because of the La Gloria case. Treasury Department has asked House ways and means committee to revise the law to reverse that federal district court decision. Court held La Gloria was entitled to apply depletion to income from sale of liquid hydrocarbons extracted from natural gas (See Watching Washington, p. 73).

Treasury request has effect of opening debate earlier than expected.

▼ ▼ ▼

Oil-country steel shipments this year are expected to double 1958, according to one steel-industry forecast.

Shipments last year were off 60%. Besides, a million tons of steel were used out of tubular-goods stocks during the year. This extremely low inventory position plus an expected jump in need for steel is back of current oil-company rush to buy. A steel strike this year could slow up the oil industry.

Several mills in January booked twice as much tonnage as they did in December. All expect to operate at capacity over next 4 months.

▼ ▼ ▼

Florida may reenter the wildcatting picture with more vigor during the next couple of years.

Two significant wildcats already are under way: Sun Oil has test near contract depth in Gadsden County in Florida Panhandle. Gulf Oil has other on State Lease 826-Y offshore from Monroe County near Key West.

Other deep wildcats are rumored for the state, which offers geologists many baffling subsurface problems. Many wells have been drilled in the past. Many have had shows. But commercial production has been limited to the small Sunniland field, a Humble operation.

Active wildcat play is carded for northwestern portion of Anadarko basin. At least 50 wells are planned in next 3 years.

Some deals are already firm.

A Tulsa firm, Sands Petroleum, will drill 11 wells on a farmout from Phillips in southeastern Colorado. The series of tests will look at the Pennsylvanian in Baca, Prowers, and Kiowa counties.

Other wildcatting areas include Union County, N. M.; Hamilton, Stanton, Kiowa, Morton, and Meade counties, Kan.; Palo Duro basin and Lipscomb County, Texas; and Woodward, Texas, and Harper counties, Okla.

Development drilling is in store for Big Piney area of Wyoming's Green River basin.

Belfer Natural Gas Co. will drill 35 wells in region.

Another Wyoming area to watch: Carbon County, where Atlantic Refining has offset to last year's O'Brien Springs Tensleep Pennsylvanian discovery. New well is west of field's opener which was hailed as major oil strike for state. The first offset to the northeast was dry.

Lease play finally is developing in Arizona's Pinta Dome field, one of nation's strangest gas areas.

Discovered in 1950, field has gone practically undeveloped, although discovery well had prolific flows from two shallow zones. Reason: Gas wouldn't burn—it had no methane. Big development is ahead now because gas is loaded with helium which commands a premium price (p. 78).

South Louisiana oil men are optimistic about outlook for offshore drilling this year.

What probably will happen is this: A good pickup in wildcat operations in the shallower water, not too much increase in drilling farther out to sea.

Renewal of deeper water boom must await progress in cutting operational costs. Some advances are being made in the direction of cheaper offshore drilling, and this may eventually lure more independent operators into the play.

Second drilling rig is being prepared for installation on California Standard's drilling platform off Summerland, Santa Barbara County.

The platform is California's first and only permanent offshore drilling platform. It originally was designed to drill two wells at once. The second rig was delayed until first rig had completed several wells. Now the second rig is expected to be ready for work by July 1.

Incidentally, the platform, located 2.2 miles offshore in 100-ft. of water, recently passed its first bad weather test without incident when it was buffeted by 14-ft. waves and 75-mph. winds.

▼ ▼ ▼

New method for sulfur recovery from gas streams has been given thorough pilot tests by Pan American Petroleum.

Process is the direct catalytic oxidation of H_2S to sulfur. The H_2S can be oxidized without at the same time oxidizing the paraffinic hydrocarbons present in the gas stream.

Other advantages: The direct oxidation plant costs about 60% of a conventional Claus sulfur plant. It also is adaptable to small tonnage plants.

At least one refiner has regenerated Platforming catalyst. Others are seriously considering this step.

Results show that about 80% of dropoff in activity may be recaptured by careful regeneration. Conditions call for a nitrogen atmosphere, some hydrogen present, and carefully controlled oxygen level. Temperature is not allowed over 975° F.

Refiners note: Watch for a new refining process to be announced later this week by Universal Oil Products Co. A paper on the process is being presented before the Western Petroleum Refiners Association's annual meeting in San Antonio.

Consent decree appears imminent in Government's antitrust suit against six major West Coast oil companies.

Attorneys for both sides have been cautioned by the U. S. judge conducting the pretrial hearings not to discuss the case since negotiations on the consent decree are at a "critical point."

Significantly, no future pretrial hearing dates have been set. Pattern has been for pretrial hearings virtually every month for the last few years.

Refiners will be interested in quality of the Russian fuel oil now invading Western markets.

Specifications on a Communist cargo due in Japan later this month are: Gravity 0.8798; flash point 75C; viscosity 27.4 (Rewood 50C); pour point -55C; residual carbon 1.01%; sulfur 0.182%; ash 0.01%; water 0.1% maximum; sediment 0.25% maximum.

▼ ▼ ▼

Texas Eastern is still interested in extending LPG pipeline service from the Midwest to the East to serve Mid-Atlantic and New England states.

Present plans contemplate use of facilities other than the Little Big Inch. This possibly means use of joint tariffs or other cooperative arrangements with interested companies.

American pipeline-construction know-how is being sought to build the Ciudad Pemex-Mexico City gas line.

Contractors and engineers in this country have been approached by Pemex officials with proposals to provide consulting services on the biggest project ever undertaken by the Mexicans.

Local contractors would perform actual construction for which a $40-million U. S. bank loan was obtained 2 weeks ago.

Mexicans also are reportedly in the market for engineering help and some equipment for petrochemical plants also being planned.

▼ ▼ ▼

World's deepest hole aimed at penetrating the earth's crust is being considered. Both federal and private financing probably will be sought for the scientific project.

Plans call for the well to be sunk from a floating drill barge in extremely deep ocean waters where the earth's crust is relatively thin.

National Academy of Sciences is spearheading the project. Its officials have been studying existing barges to determine what alterations might be needed for the superdeep well.

Washington notes: Justice Potter Stewart, newest member of the Supreme Court, is showing a conservative leaning... U. S. can expect a long period of good business. In last 100 years, time range of business recoveries has been 25 to 40 months with average at 27 months...Latest prediction: Gas tax boost won't pass. Congress instead will force Administration to cut highway spending.

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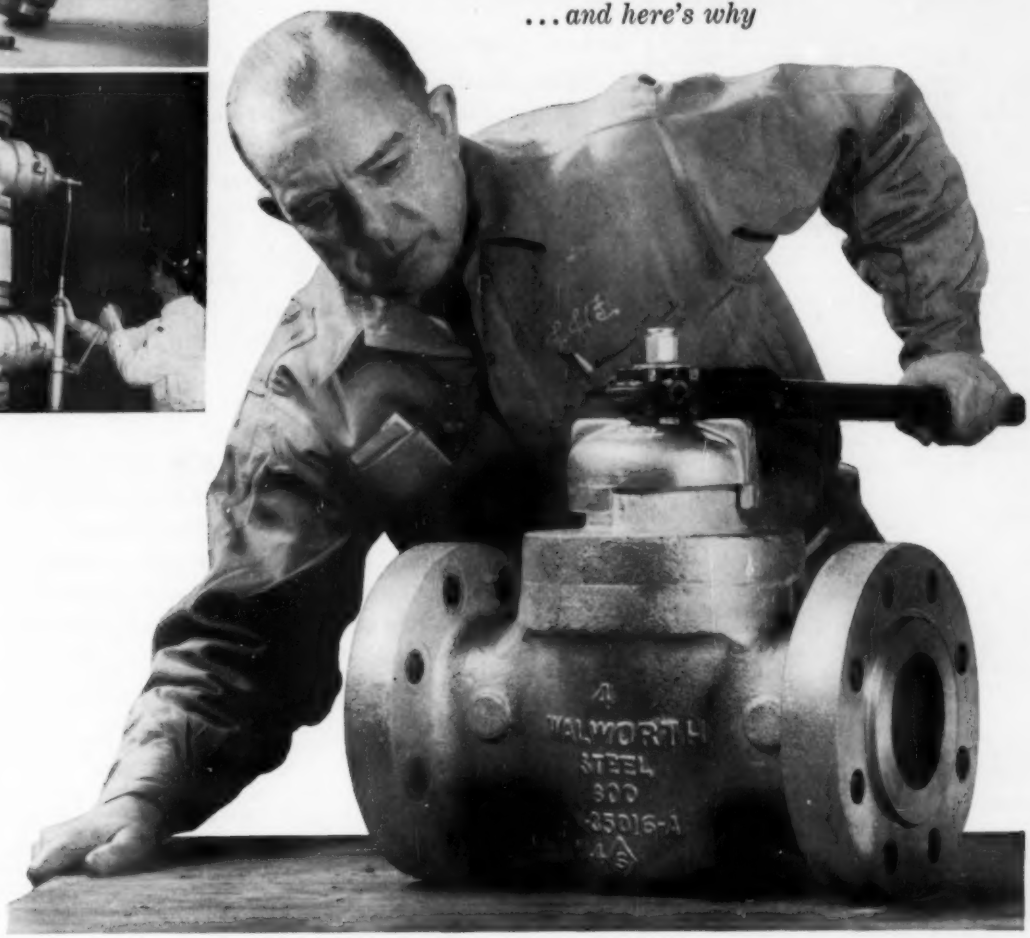

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211 South Cheyenne Ave.
Phone LUther 4-4411

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Phone Riverside 8-3074

Robert J. Enright ..... District Editor

LOS ANGELES OFFICE
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Phone MAdison 2-0722

D. H. Stormont ..... West Coast Editor
William T. Smith ..... District Editor

WASHINGTON OFFICE
621 Albee Building
Phone District 7-1710

Joe Reilly ..... Washington Editor

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SPECIAL ALASKA SECTION

There's Oil in Alaska 100
By Max Birkhauser

Oil in Alaska offers an exceptional challenge due to multiple problems. Alaskan explorationists will spend much effort to achieve the rewards that successful oil hunters will enjoy.

"Just Getting There" is Alaska's No. 1 Problem 106
By E. C. Kiesler

Point-to-point travel in many sectors of interior country can be the hardest part of the operation. Personnel movement is easy, but getting equipment on location can be a headache.

Uncle Sam—Landlord 112
By Joe Reilly

The Government is minimizing its role as a generous uncle in Alaskan land-leasing operations. The number of bargains is being decreased and the terms are becoming stiff on federal leases.

Why Independents Should Tackle Alaska 116
By Michel T. Halbouty

A well-known independent operator tells why he thinks Alaskan oil is a good investment for the small companies. Potential return is up to 10 times greater than other areas.

Who's Up There—And What Are They Doing? 120
By John R. Roderick

Although exploration activity continues at a high pace a significant factor should be noted —that more companies are making bigger investments in Alaska. Increased drilling operations bear out this point.

Alaska's Arctic Slope 125
By R. J. Burnside

Operations in the Arctic slope are not as discouraging as they appear. Oil found per foot drilled is among the highest anywhere. Recent public land offerings will attract many new investors.

Supply and Gas Transportation Can Mean Tough Sledding 154
By Ted C. Mathews and James W. Dalton

Exploration expenses will necessarily include sizable shipping costs. preplanning can drastically cut transportation charges. This complete report stresses the available facilities.

The Arctic—A Challenge in Exploration 160
By Donald J. Belcher

Exploration flexibility may mean the difference between success and failure in Alaska. A base map formed of aerial photomosaics is seen as essential to compositing all exploration data. These photos will magnify obvious problems which can be either avoided or approached properly.

TECHNOLOGY—OPERATION

Oklahoma's Laverne Field Is Active 164
By W. B. Bleakley

The Laverne area of Harper and Beaver counties of Oklahoma promise to be a major gas-producing region. The Hoover sand contains about two-thirds of the gas reserves, but three others contribute to the over-all potential. The area has new wells, new pipelines, and a new gas-processing plant.

WPRA Refining Quiz—4: Alkylation 167

Here is the material developed on alkylation at the latest El Dorado, Ark., regional meeting of Western Petroleum Refiners Association. This is the fourth portion of the transcript for the 2-day session.

Corrosion Panel Answers Knotty Pipeline Problems 173
By Gene Kinney

This is a summary of the question-and-answer session which concluded and also was the highlight of the tenth annual Tulsa Corrosion Short Course held recently. Besides the usual operating problems the course covered economics this year for the first time.

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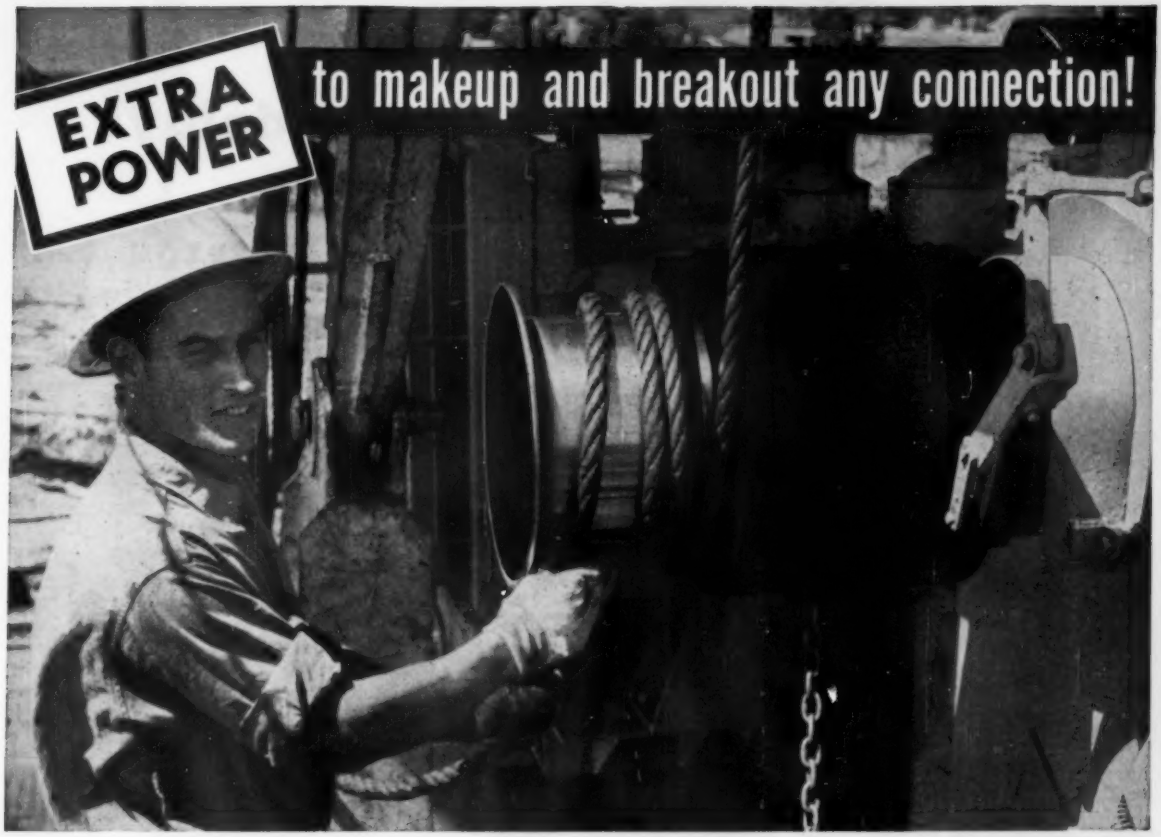

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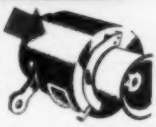

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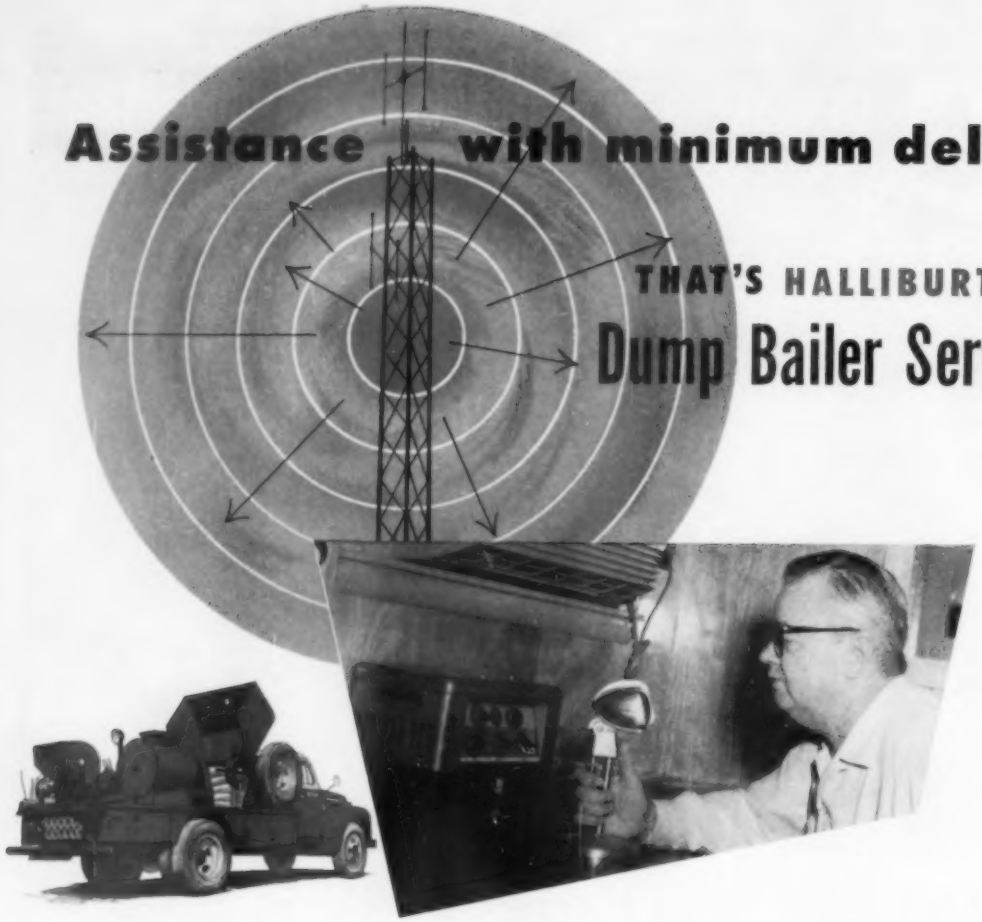

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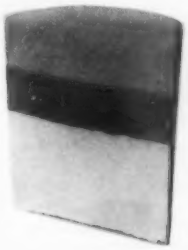
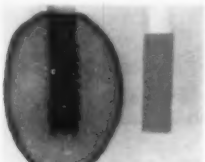


HYDROMITE

A proven waterproof plastic cement, composed of a special gypsum cement and a powdered resin, particularly adapted for dump bailer equipment . . . The setting time of Hydromite can be controlled to very close limits, with the initial set occurring within 75-100 minutes. It will set in temperatures ranging from 60°F to 225°F. . . Unlike a portland cement slurry, the resin in the fluid phase provides an impermeable seal when squeezed into the formation. This feature, together with Hydromite's 0.3% linear expansion during initial set, makes it a tight non-permeable plug for shutting off bottom hole water in producing wells.



RESIN-CEMENT

A blend of resins, water and Portland Type Cement formulated for individual well requirements. Resin-Cement is effective for open hole bottom plugs and may be placed by dump bailer or by pumping. Has application in most oil, gas or water bearing formations, including sandstone or limestone, with temperatures from 80°F to 230°F. . . Set Resin-Cement is permanent in nature and not normally affected by oil, mud, or corrosive waters or gases.

HYDRO-LOK (PC-11)

Hydro-Lok (PC-11), consisting of a thermosetting resin and inert solids used as bulking agents and for fluid loss control, is especially effective for water shutoff. This material is placed like cement slurry and may be dumped with bailer, if desired. PC-11 sets in one to three hours after being placed in the hole; the resin phase which is squeezed into the water formation sets in less than an hour because of the accelerating action of water.

HALLIBURTON

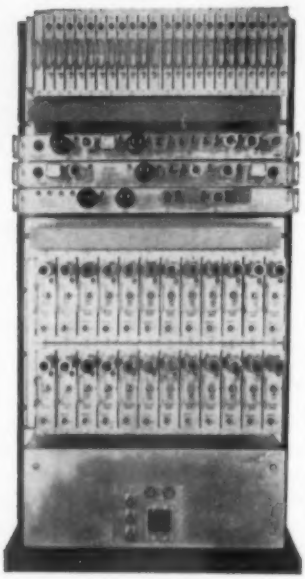
DUMP BAILER SERVICE

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

"CONTINUE TO LOOK TO HALLIBURTON—FOR LEADERSHIP"

Kellogg Sets New Standards of Reliability in Microwave

Backed by the world-wide technical, manufacturing, installation and operating experience of ITT



New MICROPLEX provides 23 plug-in channel units in 3½ feet of space—a 4:1 size reduction

Each modulator and demodulator channel unit features printed circuitry.

Microwave was pioneered by ITT in 1931 with the Channel crossing from Calais to Dover. Today Kellogg Microwave is achieving new levels of reliability: 99.998%, far superior to wire line systems! Operating in dozens of installations throughout the world, Kellogg's *complete* communications package includes:

- *Microwave* — operating in the 2,000 and 10,000 megacycles bands.
- *Terminating Equipment*—for automating functions, including teletype, telemetering, remote control, data transmission.

Part of the Kellogg 10-C Microwave System is the new 10-C-2 "Microplex": a 23 or 45 channel PTM multiplexing equipment. It features printed circuits, miniaturized components, minimum maintenance, and occupies only three-and-one-half feet of rack space. All demodulators are semi-passive—only one tube per channel; modulators are passive—no tubes. The 23 channels use 41 tubes with an input of 180 watts —a 5:1 reduction in power consumption.

MICROPLEX may also be packaged in one seven-foot rack to provide 45 channels; or 23 channels with two-wire termination and tone signaling. Signal crosstalk is 62 db and signal-to-noise (F1A) is 70 db for 23 channels.

Our engineering staff is always at your service—ready to discuss your communications problems. Write for complete details.

Kellogg Switchboard and Supply Company,
6650 S. Cicero Avenue, Chicago 38, Illinois.
Communications Division of International Telephone and Telegraph Corporation.

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Chicago 32, Illinois
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Minneapolis 16, Minn.
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Dallas 7, Texas
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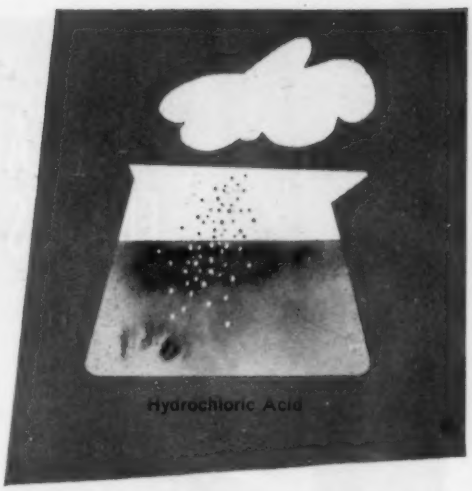
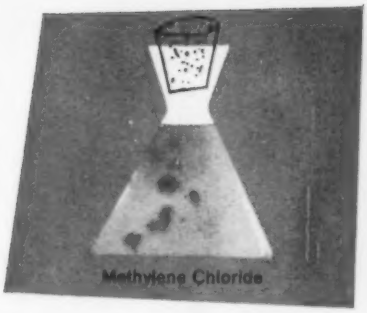
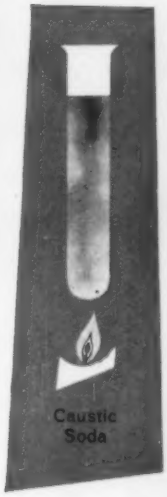
EXPORT 157 Prospect Street, Passaic, New Jersey
PRescott 3-5100

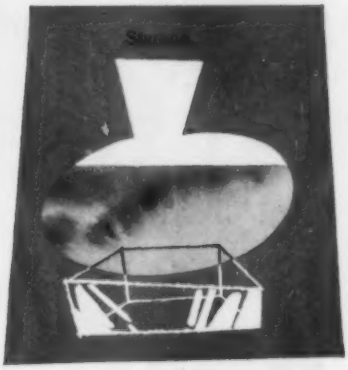
KELLOGG
CHICAGO, ILLINOIS
Communications Division of ITT

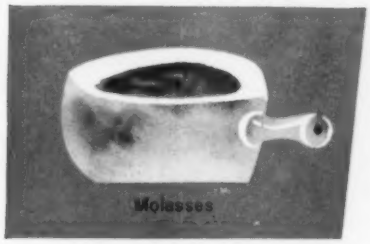
which of these
can't be stored in a
GENERAL AMERICAN TERMINAL?









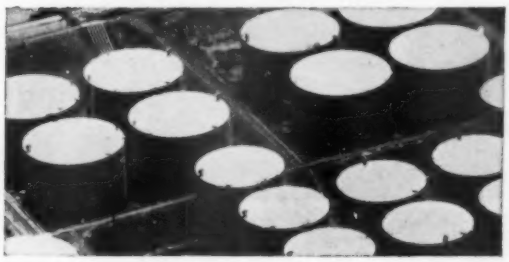


answer! General American can store them all! (and does!)

Six "problem" products! Yet each can be stored safely and economically at General American Tank Storage Terminals.

Whether your product is as volatile as methylene chloride, as corrosive as caustic soda or as viscous as molasses, General American can supply the storage facilities for your needs.

General American Tank Storage Terminals offer you the privacy, safety, service and flexibility of your own terminal—*without capital investment on your part.* Write or phone—today. You'll find... *it pays to plan with General American.*

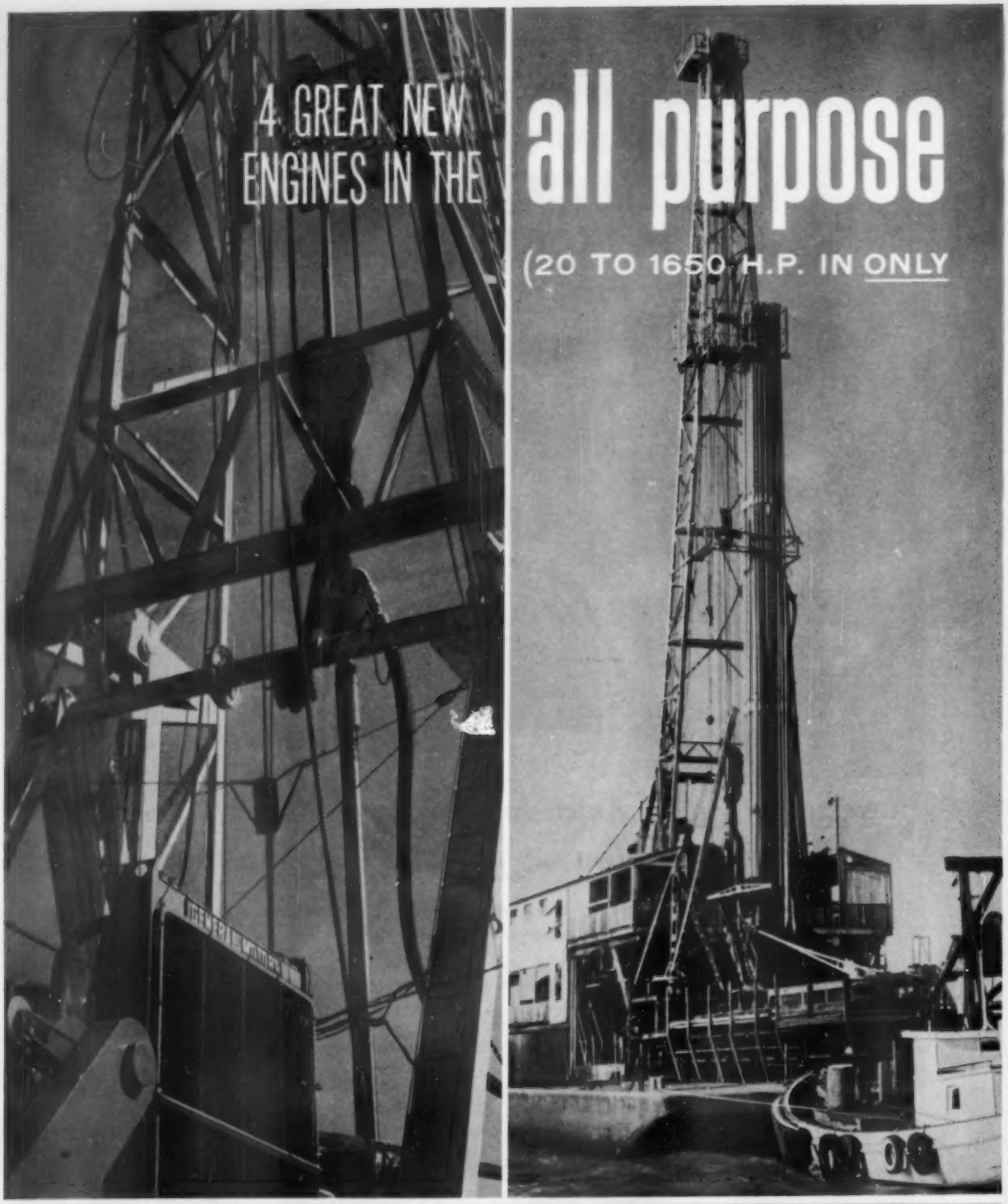


Six terminals at 5 key-market locations with over 14,000,000 barrels capacity: PORT OF NEW YORK (Carteret, N.J.), PORT OF NEW ORLEANS (Good Hope, La.), CHICAGO, ILLINOIS (Bedford Park), PORT OF HOUSTON (Galena Park and Pasadena), CORPUS CHRISTI, TEXAS.

GENERAL AMERICAN TANK STORAGE TERMINALS

a division of GENERAL AMERICAN TRANSPORTATION CORP. *135 South La Salle Street • Chicago 90, Illinois*

TANK STORAGE TERMINALS
GENERAL AMERICAN
TRADE MARK



THE GM DIESEL
ALL-PURPOSE
POWER LINE
20 to 1650 H.P.
in only 3 cylinder sizes

NON-TURBOCHARGED RATINGS

NEW
"2-53"
20 to 47 H.P.

"2-71"
33 to 67 H.P.

NEW
"3-53"
38 to 97 H.P.

"3-71"
51 to 118 H.P.

NEW
"4-53"
51 to 130 H.P.

"4-71"
69 to 167 H.P.

NEW
"6V-53"
76 to 195 H.P.

"6-71"
112 to 252 H.P.

power line

3 CYLINDER SIZES

The V-71 "Jimmy" Diesels

NEW FOR THE PETROLEUM INDUSTRY

6-, 8-, 12- and 16-cylinder "V" versions of the famous GM Series 71 Diesel

The new V-71 "Jimmy" Diesels are a further illustration of GM Diesel's mighty new power concept—rounding out the All-Purpose Power Line—yet retaining the GM Diesel family relationship and parts interchangeability.

Here are engines that combine every profit-making, cost-saving advantage any Diesel has ever had. Diesels that boast an ingeniously engineered combination of new compactness, lightweight, high efficiency, durability and inexpensive maintenance.

These V-71 "Jimmy" Diesels are available in 6-, 8-, 12-, and 16-cylinder models rated from 112 to 675 h.p. plus 24- and 32-cylinder "Twins" up to 1650 h.p., when turbocharged. They're itching to get to work wherever there's hard work to be made easy.

To see how these new members of the All-Purpose Power Line meet your needs, write GM Diesel, Dept. O-3, Detroit 28, Michigan.

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

NEW
"6V-71"
112 to 252 H.P.

NEW
"8V-71"
150 to 334 H.P.

"6-110"
160 to 335 H.P.

NEW
"12V-71"
224 to 504 H.P.

NEW
"16V-71"
300 to 675 H.P.

NEW
"24V-71" (Twin 12)
448 to 1008 H.P.

NEW
"32V-71" (Twin 16)
600 to 1350 H.P.
(Turbocharged—1650 H.P.)

Tailor-made, tough and chemically inert...

. . . these J-M Chempac Teflon components combat chemical and solvent action!*

SMALL OR LARGE . . . intricate or simple . . . J-M Chempac® Teflon components have proved their exceptional resistance to the constant attack of corrosive chemicals in rugged service.

Look to J-M for Teflon packings, gaskets, and moulded shapes made to your exact specifications . . . or for parts that are machined to close dimensional tolerances. Moreover, we can combine Teflon with top quality J-M asbestos to impart the exceptional sealing and heat-resistance properties of the "magic mineral." And in addition to corrosion-resistance, Teflon gives you the advantages of an extremely low coefficient of friction . . . toughness and flexibility . . . and weight-saving possibilities.

You can also obtain J-M Chempac Teflon Packings in moulded and braided types for pumps and valves . . . in a wide range of flange and envelope-type gaskets . . . in rings, cups, sheets and tapes. Your J-M Packings Distributor can supply your needs. Or write Johns-Manville, Box 14, New York 16, New York. In Canada: Port Credit, Ontario.

*TM for DuPont Tetrafluorethylene resin.

Teflon rods, tubes, tapes and sheets —in addition to components of varied sizes and shapes as indicated here—are also available from Johns-Manville. Prompt delivery of any quantity you need is assured by new J-M production facilities.

JOHNS-MANVILLE JM PRODUCTS

JOHNS-MANVILLE

LARGE ECONOMY PACKAGE!

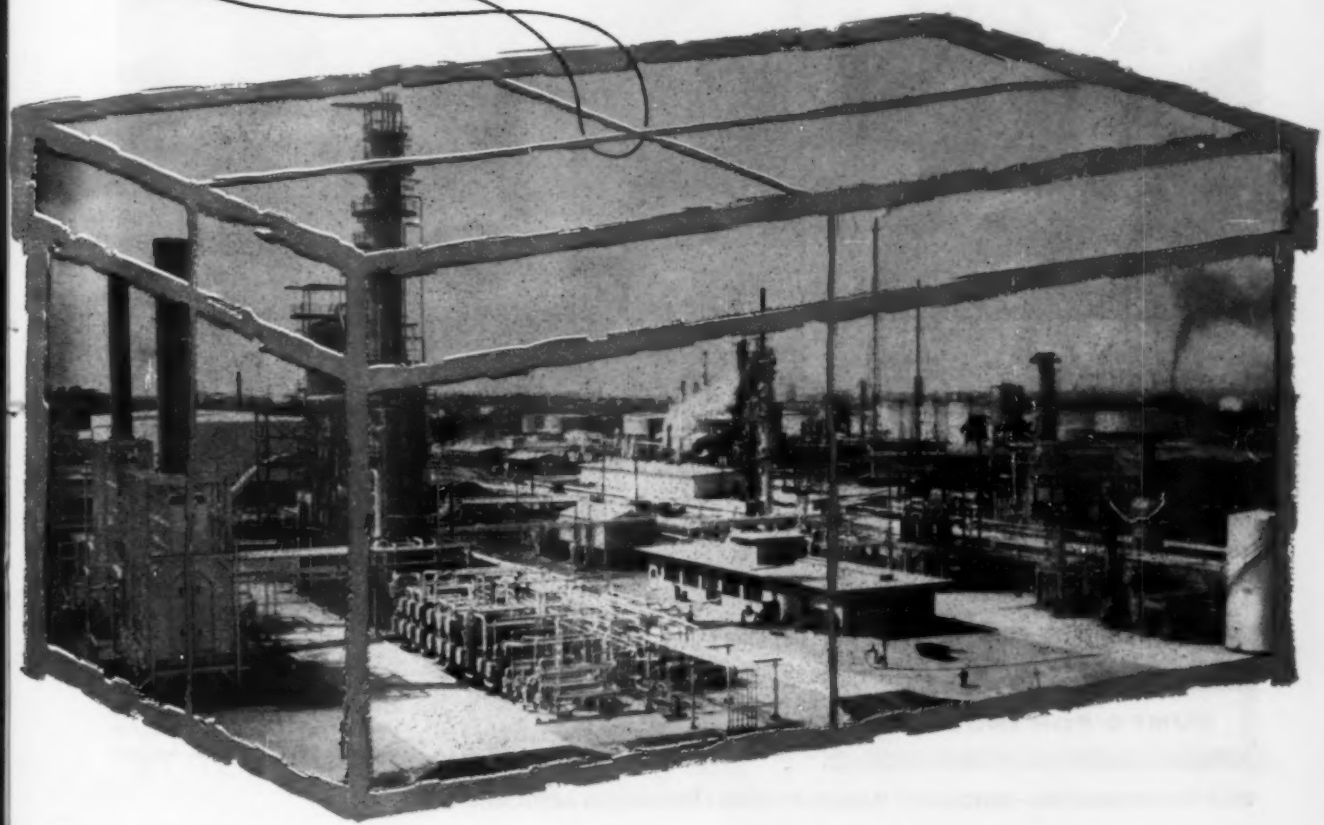
Because we at McKee-Raymond handle the complete design, engineering, and construction of overseas chemical or petroleum refineries, we refer to them as "package projects." And when you see the time, effort and money the McKee-Raymond working team can save you, you'll know what we mean by "large economy."

For example, we have over a century of experience in working in the far corners of the globe. We know the labor situation in Nairobi . . . how to get a rig over the Andes . . . when to beware of the simoon blowing across Arabia.

But more than that, both Raymond International, as one of the world's leading construction firms, and Arthur G. McKee, as an internationally renowned engineering firm in the petroleum and chemical fields, combine and apply their own specialized knowledges and skills on a single contract basis. If you're interested in planning a chemical or petroleum project in Asia, Africa, Australia, New Zealand or South America, we're interested in showing you our large economy package for 1959. For descriptive booklet, write either Arthur G. McKee & Co., 2300 Chester Ave., Cleveland 1, Ohio or Raymond International, Inc., 140 Cedar St., New York 6, New York.

McKEE · RAYMOND

OVERSEAS ENGINEERING AND CONSTRUCTION SERVICES



Which ones do *you* want licked?

They're all sour—when you have to pump corrosives. You can lick all four when your pump is made of the right materials.

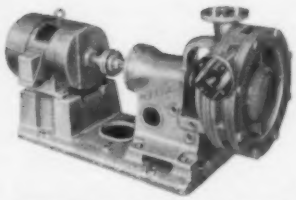
You know what you have to pump. We know how to furnish pumps to handle it.

We'd like to hear your problem.

GOULDS
PUMPS FOR INDUSTRY

GOULDS PUMPS, INC.
Dept. OG-39, Seneca Falls, N. Y.
Main Office and Works

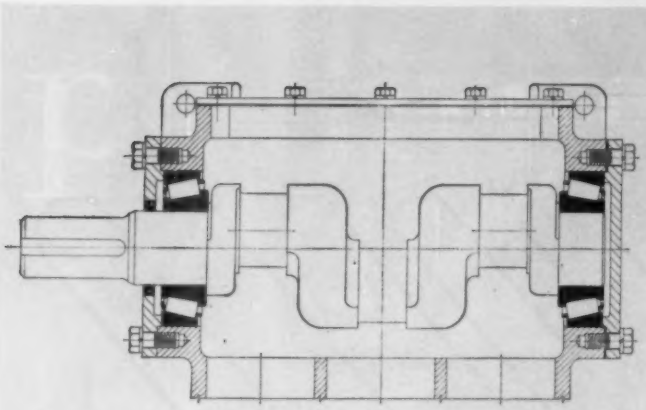
Branches and Representatives in all principal cities



GOULDS-PFAUDLER GLASSED PUMP. Here's a unique new centrifugal pump that joins the unexcelled corrosion resistance of Pfaudler glass to the sturdy construction of Goulds pumps. For complete details, send for our Bulletin 725.2.

CREATIVE ENGINEERING • INTEGRATED MANUFACTURING • ENGINEERED APPLICATIONS

New pump uses TIMKEN® bearings to get more capacity in less space, at lower cost



How **WORTHINGTON CORPORATION** mounts the crankshaft of its KCA waterflood pump on capacity-packed, space-saving Timken bearings to take heavy loads, assure dependable performance.

THIS new Worthington KCA waterflood pump is a real do-it-itself worker. It runs unattended, keeping pressure up day-in-and-day-out, under constant, heavy loads.

To keep design compact and economical, yet able to take the heavy loads, engineers selected Timken® tapered roller bearings for mounting the crankshaft. Compared to other types of bearings, they found Timken bearings gave them the higher capacity needed, in less space, and at lower cost.

Their tapered construction lets Timken bearings take both radial and thrust loads. And full-line contact between rollers and races gives Timken bearings the extra load-carrying capacity so vital in rugged oil field pumping. Crankshafts stay positively aligned; pumps work steadily, efficiently—with Timken bearings.

Because these capacity-packed Timken bearings can take greater loads—size for size than other types of bearings, designs can be simpler, more compact. Costs can be reduced. And because Timken bearings keep shafts concentric with the housing, closures are more effective. Dirt stays out, lubricant in, pump maintenance down.

And Timken bearings save power because they practically eliminate friction; they *roll* the loads. They're geometrically designed and precision-made to roll true. We even make our own electric furnace fine alloy steel for Timken bearings. No other American bearing maker takes this extra quality step.

Timken bearings make machines better. And better machines do better work. That's Better-ness. Look for its symbol, bearings trade-marked "TIMKEN", on the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO".

This symbol on a product means its bearings are the best.

Visit us at the INTERNATIONAL PETROLEUM EXPOSITION, May 14-23, 1959—Booths 139-142, Oklahoma Building, Tulsa, Oklahoma.

BETTER-ness rolls on **TIMKEN®** tapered roller bearings

in handling on-the-job accidents

. . . cut down lost time
. . . reduce medical expense
. . . improve employee morale
. . . help keep your work force at peak efficiency

That's what Texas Employers' claims service from 25 key locations can do for you. And, you should know that TEIA has provided this and other services for 44 years, and at the same time, helped Texas business and industry save nearly $60,000,000 on the cost of workmen's compensation insurance.

Thousands of businesses, both large and small, are taking advantage of these services and savings. Why don't you? Call your nearest TEIA office today.

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TEXAS EMPLOYERS
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HOME OFFICE:
EMPLOYERS INSURANCE BUILDING
DALLAS, TEXAS

AUSTIN F. ALLEN, *Chairman of the Board* BEN H. MITCHELL, *President*

IT'S A MATTER OF

pulling together!

GOODYEAR

And here's how Green Seal V-Belts by Goodyear make pulling together pay—and pay—

On every type of drive—in every part of America—Green Seal by Goodyear are and outlast anything

—AT AN OHIO CHEMICAL PLANT

Operation: Pulverizing nickel formate

Drive: Main drive on micro-atomizer—handles 20 h.p. at 5,868 f.p.m.

Service: *Eight matched V-Belts with the Green Seal served for more than 6 months compared with 4-week life for 10 belts of another make.*

—IN A MISSOURI PIPE PLANT

Operation: Making fire clay and sewer pipes

Drive: 125 h.p. ball-mill drive

Service: *Fourteen matched V-Belts with Green Seal construction served 6 years without maintenance of any kind.*

every kind of industry—in matched V-belts with the pulling together to outperform else belt-users can buy—

—ON A TEXAS OIL RIG

Operation: Drilling oil wells

Drive: Main drive on mud pump

Service: *20 V-Belts with the Green Seal pulled together to drill 202,790 feet of hole—more than 25% better than the average belt-life in this service.*

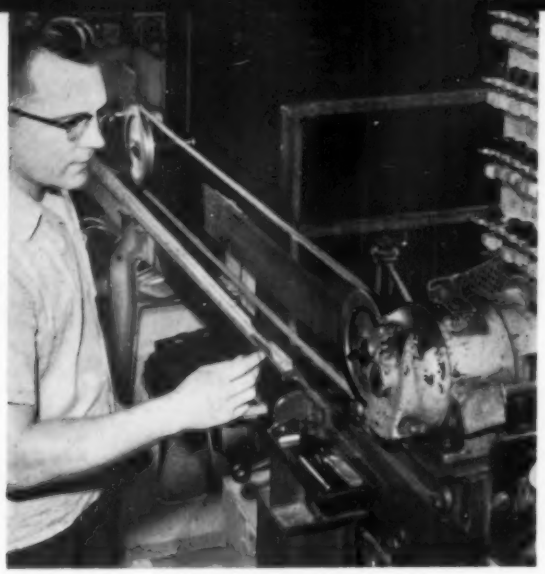
—AT A SOUTH CAROLINA FABRIC MILL

Operation: "Soaping" screen-printed fabrics

Drive: 50 h.p. "soaping" range drive with belt speed of 1,413 f.p.m.

Service: *Ten matched V-Belts with Green Seal construction served 8 years with virtually no time out.*

Here's why **V-BELTS** with the **Green ✿ Seal** always pull together



The secret's their unequalled dimensional stability. And it's built into each belt via special tension members of steel cable or exclusive, synthetic Triple-Tempered (3-T) Cord. Then every set is precision-measured – several times over – to make sure they are perfect teammates.

That means matched sets really match. Every belt does its part of the job. There are no "loafers" to put extra strain on the other belts. No belt ever overworks and causes a premature failure. It's strictly a matter of *pulling together* – whether your drive calls for two or fifty belts.

What's more, every V-Belt with the Green Seal is designed to outperform all others. High in modulus, they're low in stretch to minimize take-up. They're friction-balanced – so covers don't stick or grab in the grooves. They're non-dusting, too.

In short, these are the belts that give you maximum, trouble-free hours at minimum cost. You need belts like these to pull together on your drives–large and small.

Just contact your Goodyear Distributor–or fill out the handy coupon below.

Green Seal–T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

DIMENSIONALLY STABLE V-BELTS WITH THE GREEN SEAL BY

GOODYEAR

THE GREATEST NAME IN RUBBER

S-51162

THE GOODYEAR TIRE & RUBBER COMPANY, Industrial Products Division, Dept. 794, Akron 16, Ohio

Please send me more information about how V-Belts with the Green Seal solve the major problem in belting multiple V-Belt drives.

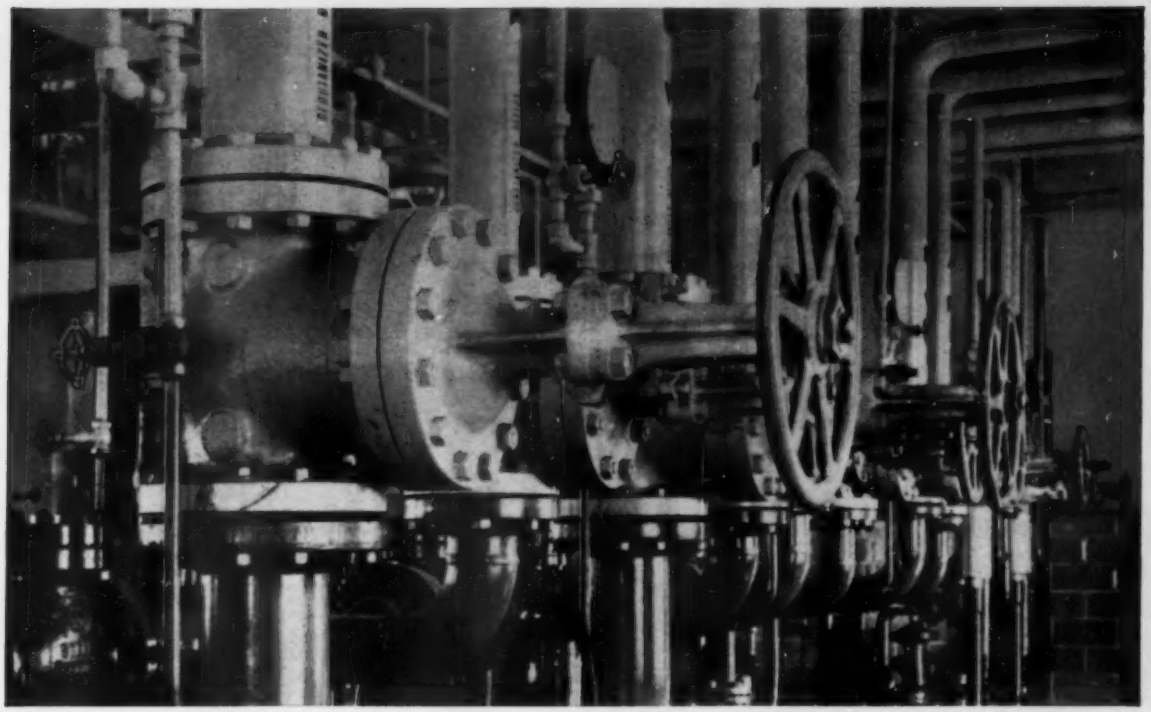
Name .....

Company .....

Street Address ..... City ..... Zone ..... State .....

Don't Hedge on Quality When You Buy Steel Valves...

Maintenance costs can gobble up your savings in a few months!



LUNKENHEIMER QUALITY is no longer a luxury—it's your vitally needed insurance against today's sky-high maintenance expense. Labor rates are going still higher . . . "downtime" costs are multiplying . . . repair charges are rocketing up—with no relief in sight. Today, it pays to buy the *best valves you can get,* with no hedging on quality. Your purchase of Lunkenheimer Steel Valves is an investment that pays worthwhile dividends in maintenance savings . . . year after trouble-free year. The Lunkenheimer Company, Box 360, Annex Station, Cincinnati 14, Ohio.

The cost of a LUNKENHEIMER VALVE
Gets smaller...and smaller...and smaller...
with each passing year of dependable service

A check on the cost of maintaining your cast steel valves will prove this point.

STEEL • BRONZE • IRON • PVC

L-1086-2

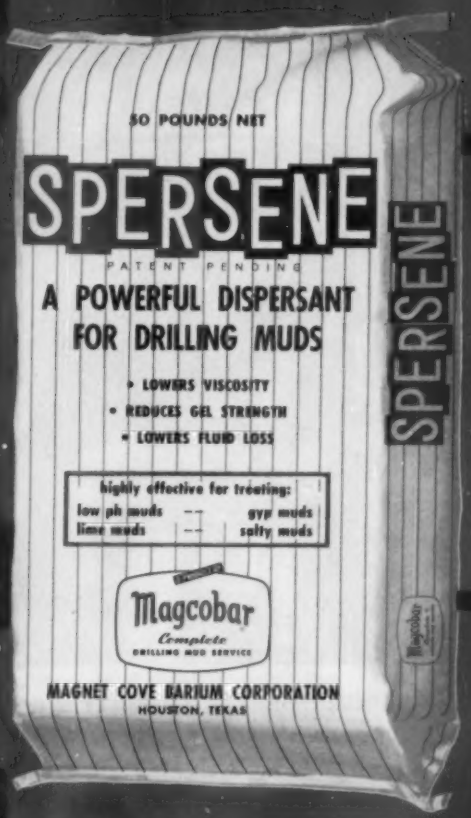
LUNKENHEIMER QUALITY

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

Now

SPERSENE

Magcobar's *new* all-purpose dispersant cuts costs *in any kind of mud*



another *well done*

Spersene, a very versatile thinner, performs well in any mud. Its powerful thinning action combined with low cost make it a unique chemical for treating any drilling mud. You need no longer stockpile a number of dispersants at your well to meet different mud conditions. Now, you can simplify mud treatments with this new all-purpose dispersant and cut mud chemical costs, too.

Spersene costs less when you buy it; costs much less when you use it. As the tables show, Spersene lowers viscosity more effectively, at less cost, than any of today's leading thinners. This means a lower cost per barrel with Spersene. When projected to well volume, it means surprising savings. Whether you are using high or low pH mud, gyp mud, lime mud, or seawater or brackish mud, laboratory tests prove that Spersene

	Amount (pounds)	MATERIALS	Average Cost (Cents)	VISCOSITY (Yield Point-lb./100 ft.^{2})
gyp muds	1	Spersene	16.5	7
	1	Thinner A	18.5	14
lime muds	3.0	Spersene	49.5	6
	3.0	Thinner A	65.5	16
low pH muds	1	Spersene	16.5	8
	1	Thinner A	18.5	12
	2	Thinner B	20.0	20
	1	Thinner C	18.0	18
	1	Thinner D	17.0	31
sea water muds	4	Spersene	66	1
	4	Thinner A	74	3

is more efficient on basis of costs than any other dispersant. And it is very stable against the upsetting effect of salt.

Spersene is one more specific Magcobar solution to the problem of high drilling costs, one more development from the Magcobar laboratories that will increase your profit through more economical drilling. From spudding in to total depth, you'll find that the right products *used right* by Magcobar engineers can cut your drilling costs, too. Write for the new bulletin on Spersene.

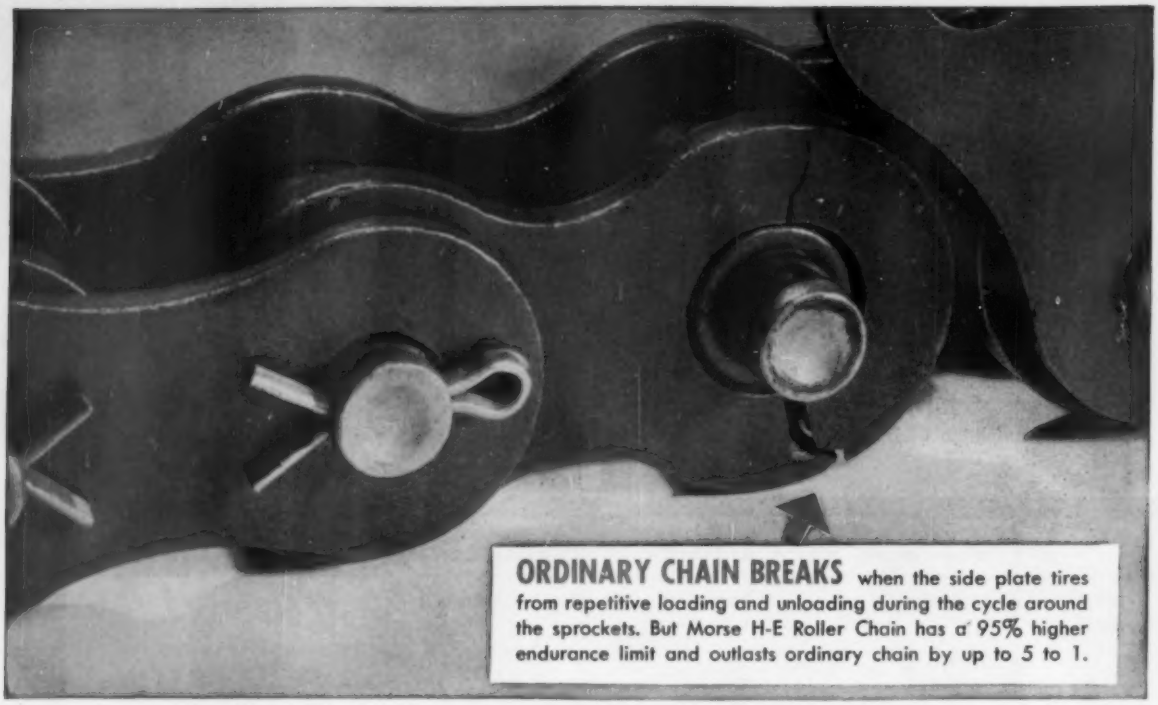
Wherever your drilling operations, you can use Magcobar engineering and products. There are more than 500 stockpoints in the U.S. and Canada. Elsewhere, write Foreign Operations, P. O. Box 6504, Houston, Texas

with Magcobar Technology

Magcobar
Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION

Houston



ORDINARY CHAIN BREAKS when the side plate tires from repetitive loading and unloading during the cycle around the sprockets. But Morse H-E Roller Chain has a 95% higher endurance limit and outlasts ordinary chain by up to 5 to 1.

"Tired Metal"... the bane of chain now licked by MORSE H-E

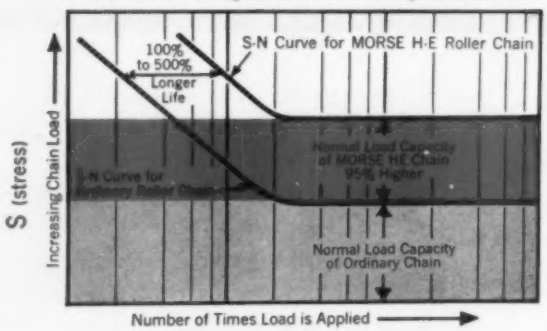
Morse H-E Roller Chain outlasts ordinary chain by up to 5 to 1 . . . can save you thousands of dollars annually on tough drilling jobs

Deep drilling puts chain under terrific loads and shocks until metal "tires," and ordinary chain breaks. But a special process gives Morse H-E Roller Chain 95% higher endurance limit . . . up to 500% longer service life.

This special process means Morse H-E Chain costs up to 10% more. Yet that's a small price to pay for heavy-duty oil-rig chain that can save you thousands of dollars yearly in replacement costs and downtime.

For more information on the chain that licked the "tired metal" problem, check your favorite supply store. Or write: MORSE CHAIN COMPANY, Dept. 22-39, Ithaca, New York. Warehouses in Casper, Wyoming; Houston and Odessa, Texas; Farmington and Hobbs, New Mexico. Export: Borg-Warner International, Chicago 3, Illinois.

Chain Life: Morse High Endurance vs. Ordinary Roller Chain


100% to 500% Longer Life
S-N Curve for MORSE H-E Roller Chain
Normal Load Capacity of MORSE HE Chain 95% Higher
S-N Curve for Ordinary Roller Chain
Normal Load Capacity of Ordinary Chain
S (stress) Increasing Chain Load
Number of Times Load is Applied
N (number of cycles)

Red area: Under these chain loads, fatigue will break ordinary chain . . . but not Morse H-E.

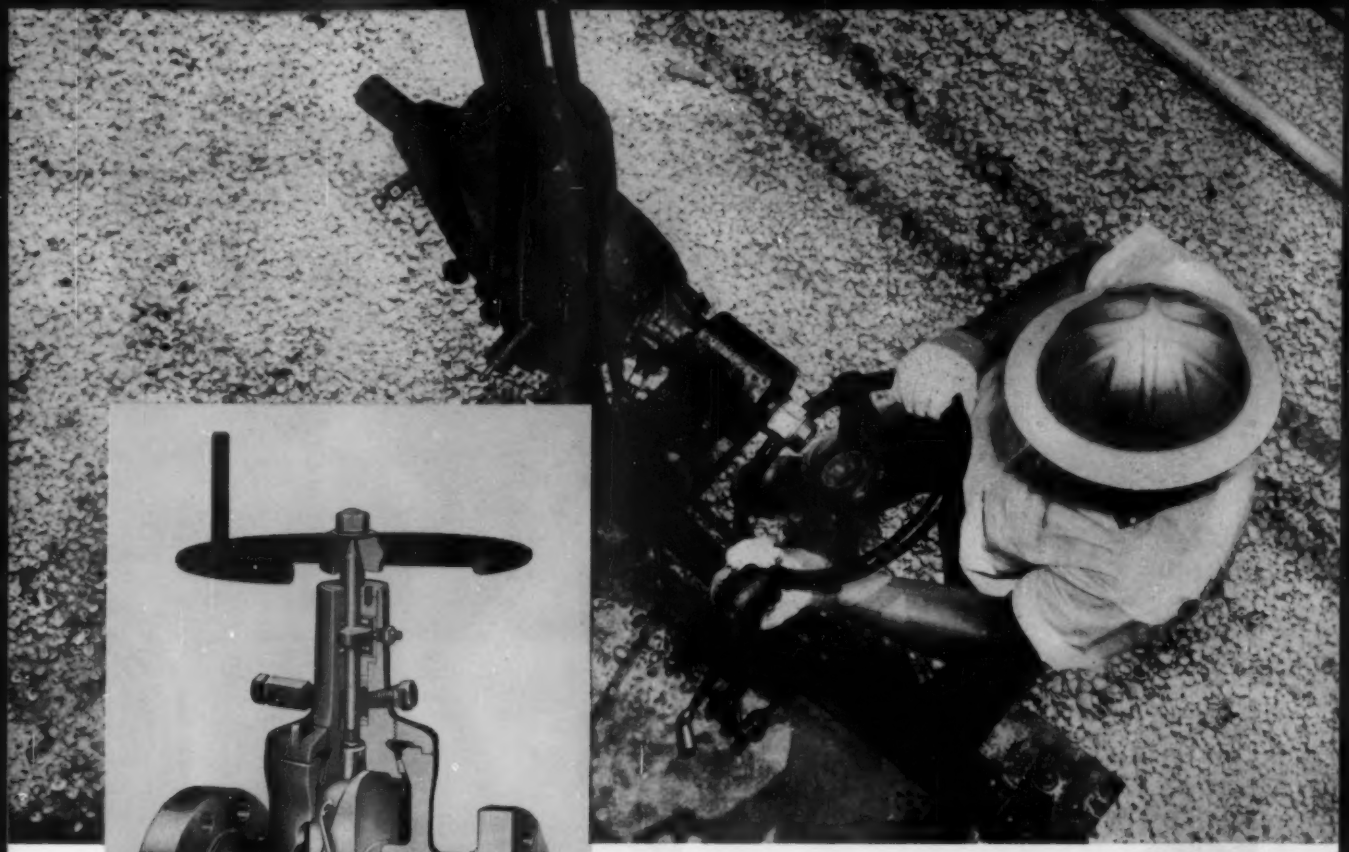
White area: Under these loads, fatigue will break ordinary chain and Morse H-E . . . but Morse H-E will have operated 100% to 500% longer.

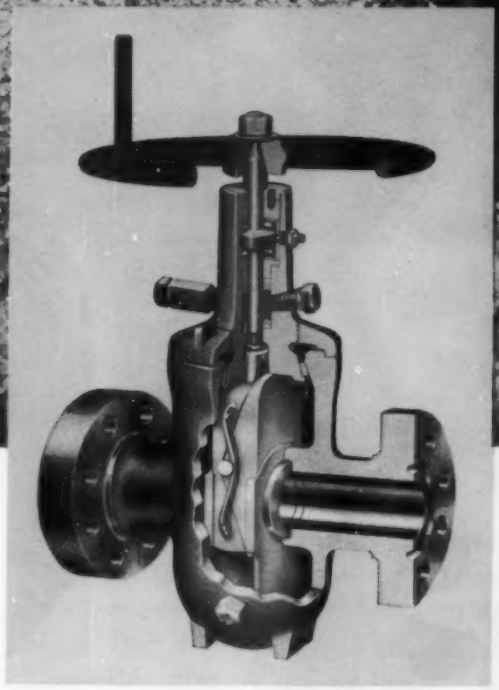
MORSE* BW

*Trademark

A BORG-WARNER SUBSIDIARY

Visit Morse at the International Petroleum Exposition in Tulsa, May 14-23, Booth 14-16, Silver Lane





Practical advantage of W-K-M's *Creative Engineering*:

On-the-line overhaul!

Fast, easy overhaul of W-K-M Gate Valves while on the line saves you time and money and contributes to the overall efficient performance and long-range economy that W-K-M valves are noted for.

Other benefits include parallel expanding gates, controlled force seating, free flow through the valve without any more turbulence or pressure drop than through a smooth-wall pipe, Teflon seat inserts (in all valves up to 5,000 psi working pressure), and superfinished stems.

Available in standard types, balanced stem*, recessed body, dual and triple completion types. Sizes range from 1½" through 7" for pressures ranging from 500 to 15,000 psi working pressure.

* *Illustrated above right*

Completely dependable

The superior performance of W-K-M production valves is attested by the experience of users.

These valves have earned a reputation that inspires confidence throughout the world. Field men recommend them; engineers specify their use.

W-K-M valves set industry standards for design . . . reliability . . . easy operation . . . and long-range economy.

On hand at your supply store

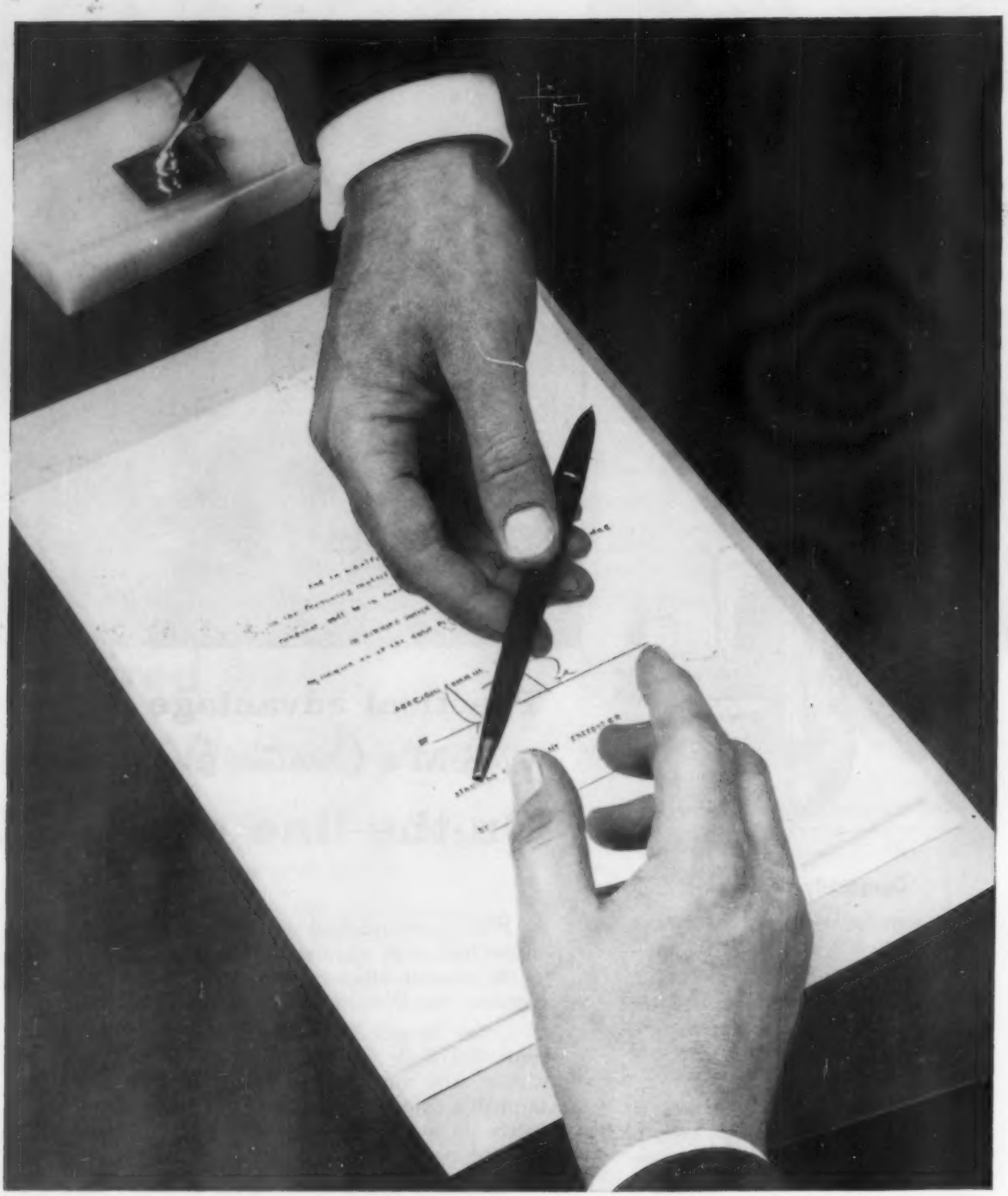
The most used sizes of W-K-M gate valves are carried by supply stores everywhere. Special sizes and special designs are produced as you need them.

WRITE FOR CATALOG 200
which describes W-K-M
Through-Conduit Gate Valves
for oilfield services.

W-K-M

DIVISION OF ACF INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS
Export Office: 45 ROCKEFELLER PLAZA, NEW YORK, N. Y.

5819



"Respect for contracts is a fundamental element of civilized life. Unless such respect is firmly established as a moral and legal rule, the economic stability and peaceful progress of the entire free world are inevitably hampered."

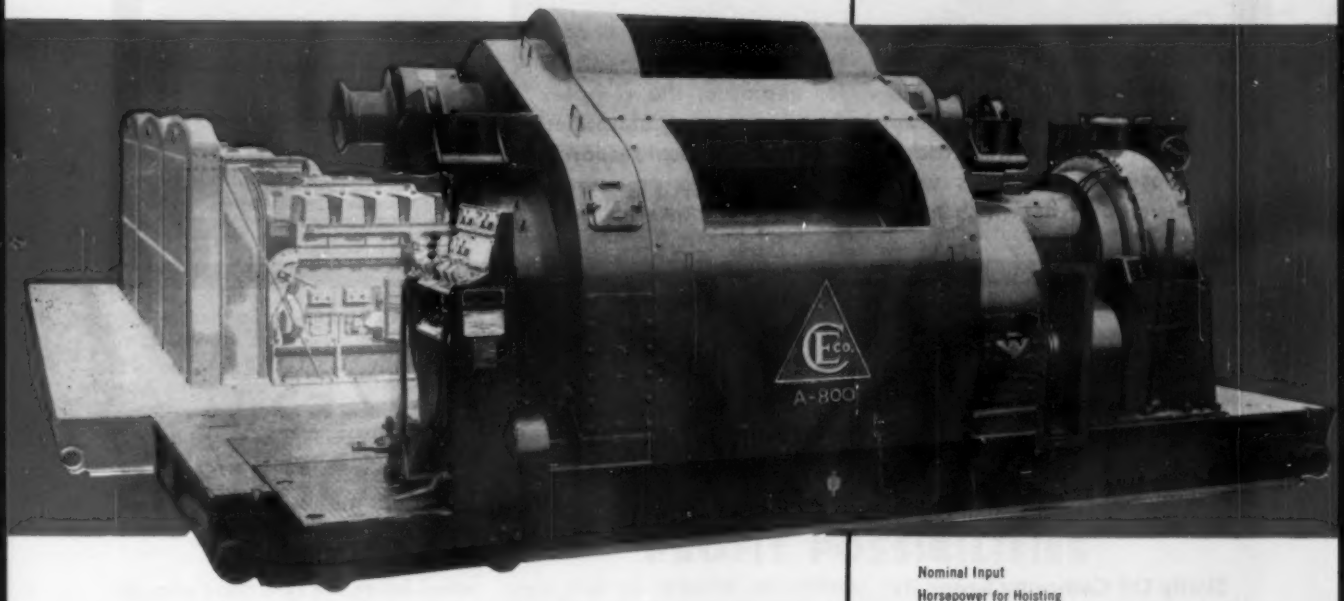
— M. J. Rathbone, President

Standard Oil Company (New Jersey)
and affiliated companies

ESSO

CONTINENTAL-EMSCO

A-SERIES rigs are as flexible as your drilling requirements



Power ends for A-Series rigs are designed for maximum *power flexibility* . . two, three or four engines . . 700 to 1800 horsepower . . variety of four pump drive arrangements. Four drawworks sizes provide a wide drilling range. This gives you latitude in assembling the minimum amount of rig equipment . . contract by contract . . to drill at the *lowest possible* cost per foot.

You'll save on rigging-up and tearing-down time too. Sections are easily, quickly assembled . . move in compact, low-cost truck loads.

A-Series rigs open up more jobs for you . . make you *fully competitive* . . help you make more money on each job. Your Continental-Emsco man can give you detailed information . . call him today.

Nominal Input Horsepower for Hoisting
A-550 Rig—700 hp
A-800 Rig—1000 hp
A-1100 Rig—1400 hp
A-1500 Rig—1800 hp

DESIGNED TO CUT DRILLING COSTS.. LABOR COSTS.. INVESTMENT COSTS

For Service that Sings . . Equipment that Hums . . Go . .

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries Worldwide

R802

CONTINENTAL-EMSCO COMPANY • A Division of The Youngstown Sheet and Tube Company • General Offices: Dallas, Texas
Export Division: 30 Rockefeller Plaza, New York, N. Y. • Continental-Emsco Company Limited • General Offices: Calgary, Alberta, Canada
Continental-Emsco Company C. A., Caracas, Venezuela • Plants: Houston and Garland, Texas; St. Albans, Herts., England • Representatives in All Principal Oil Fields of the World

DOW | **Cracking plant for petroleum problems**

Oil and gas companies are finding, lately, that they're getting a lot of valuable help from people who aren't on their payroll. Here at Dow, for example, the complex problems of the petroleum industry are being simplified continually by the "cracking plant" of chemical research. These news reports will keep you posted on current developments which may prove profitable to you.

You may wish to check certain items in this advertisement and forward to those concerned in your own company.

Route to:

_____

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DOW CLINIC SPECIALIZES IN GAS CONDITIONING PROBLEMS

Skelly Oil Company keeps its gas treatment in healthy shape by sending its amine solutions for regular check-ups. Other firms also profit from service of Dow Gas Conditioning Lab.

They run a unique clinic at Midland, Michigan. The "patients" are problems . . . problems brought here by gas conditioning companies.

"You don't have to be in serious trouble to benefit from this service," says a member of the Gas Conditioning Laboratory staff. "We're happy when even a small contribution from us helps a customer improve the overall efficiency of his processing plant."

The Skelly Oil Company is a case in point. Skelly has regularly submitted samples of the monoethanolamine solutions used in their gas processing plants for analysis. Complete data on the corrosion and foaming characteristics of these solutions have been helpful in overcoming production difficulties.

A user of activated carbon filters in their amine units, Skelly also has drawn on the resources of the Dow laboratories for reports on the type of materials removed by these filters and the approximate capacities of carbon filters.

Answers for the industry—The case histories of successful remedies prescribed by the Dow lab are invaluable in helping solve problems for the gas conditioning industry. In fact, these case histories point to leadership in the gas conditioning field. Should you be looking for answers to a long list of processing problems, including high temperature corrosion, glycol contamination, salt contamination, high glycol losses and solidification of paraffin, you, too, may want to look to Dow.

Armed with case histories of successful remedies prescribed by the Dow laboratories, plus a host of additional data, the Dow technical serviceman leaves on a trouble-shooting call equipped to do the job.

If the customer's problem has been solved before, the Dow man carries the solution in his brief case. If the problem is a new one, he'll know it's new without trial and error probing—and refer it to his technical laboratory for the same clinical analysis which has turned problems into profit so many times before.

Those who may have experienced difficulties or doubts in connection with gas sweetening and dehydrating processes would do well to consult this "free clinic" at Dow. The prognosis is generally bright. As one laboratory supervisor said: "We haven't lost a patient yet".

Samples of monoethanolamine solutions from the Skelly Oil Company are tested in Dow Gas Conditioning Laboratory.

DOWTHERM 209

Ebullient cooling comes of age

Owners and operators of large internal combustion engines laboring in the refining and chemical processing industries can look forward to longer engine life and improved performance. These are the benefits of using Dowtherm® 209, the new, freeze-point depressant for ebullient cooled engines.

Wherever freezing problems exist, Dowtherm 209 and ebullient cooling offer the advantages of uniform heating, faster engine warm up, automatic circulation and temperature control, reduced corrosion and lubricant contamination—not to mention the use of waste heat for low pressure steam.

Freezing problems which had prevented ebullient cooling from achieving widespread application have been overcome by Dowtherm 209. With a boiling point of 209°F., it also permits engines to run at higher, more efficient temperatures . . . on cheaper fuels. Uniform heat transfer provides even cylinder wall temperatures—with reduced "blow-by" (oil blowing past piston rings).

Dowtherm 209 azeotropes with water. The azeotropic mixture has a boiling point of 209°F. It provides freeze protection to a −45 or −80°F. as required. Special inhibiting action minimizes corrosion.

Engineers have already reported many profitable changeovers to ebullient cooling with Dowtherm 209. In about ninety-five per cent of the cases, conversion is a simple matter.

* * * *

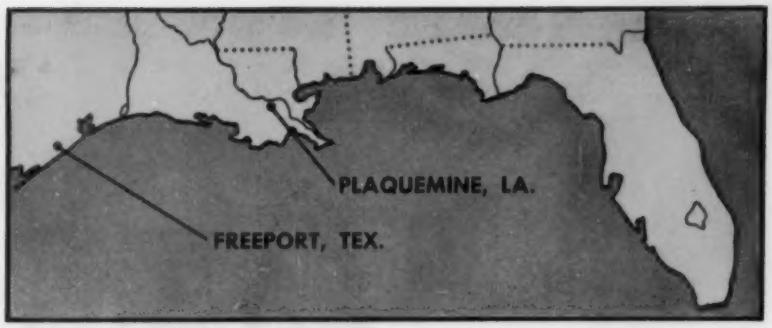
For more information on these and other chemicals important to the oil and gas industry, contact the Dow sales office nearest you or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Chemicals Sales Department 950DC3-16.

DOW CHEMICALS BASIC TO THE PETROLEUM INDUSTRY

Alkalies • Amines
Glycols • Polyols
Muriatic Acid • Solvents
Ammonia • Phenol
Calcium Chloride • Germicides
Bromine • Chlorine
Weed, Grass & Brush Killers

THE DOW CHEMICAL COMPANY
Midland, Michigan

DOW



CAUSTIC SODA *Within arm's reach of offshore developers*

"*Closest* with the mostest," pretty well sums up the supply situation of Dow caustic soda for the Gulf Coast offshore petroleum development area.

Two Dow producing plants—at Freeport, Texas, and Plaquemine, La.—are within arm's reach of this industrial giant in the Gulf region. The petroleum industry's appetite for caustic soda is enormous. But it always finds supplies from Dow ready and waiting.

"You might call us the caustic soda logistics experts for the petroleum industry," a Dow spokesman said. "Wherever they set up shop, the Dow caustic supply line is already there."

Explore these other

PROFIT POSSIBILITIES

CHLOROTHENE®

New, high cleaning power for general equipment cleaning. Safety features make it best solvent for cleaning electric equipment. Ask about Chlorothene (Dow 1, 1, 1-trichloroethane, inhibited).

DOWICIDE®

These Dow preservatives protect drilling muds with a high starch content from decomposition in open storage at the drilling site. Also used to control slime, fungi, algae in cooling towers.

ETHYLENE AND PROPYLENE OXIDE

Investigate these two versatile compounds for upgrading petroleum products. Strategic shipping points assure prompt, dependable delivery.

AMMONIA

Dow is source of high quality ammonia for use as corrosion inhibitor in cracking stills, bubble towers, straight-run fractionators. Controls hydrogen sulfide corrosion at lower cost than coatings.

THIS IS THE IMAGE OF CF&I...

maker of steel products for every industry

Automotive Wire Products • Baling Wire and Ties • Barbed Wire • Belts—Woven Wire Processing • Bridge Products Chemicals and Coke • Door Hardware (Garage, Overhead, Sliding, Fire Door) • Electrical Wire and Cable • Fabricated Steel Plate Products • Fence, Chain Link, V-Mesh, Woven Wire, Ornamental • Fence Posts • Fence Stays • Flower Bed Border • Gates • Galvanized Steel Strand • General Purpose Welded Wire Fabric • Grader Blades and other Cutting Edges • Grinding Balls • Grinding Rods • Grizzly Bars • Hardware Cloth • Industrial Wire Cloth • Insect Wire Screening Mine Rails and Accessories • Nails, Staples and Spikes • Nettings—Poultry, Stucco, Fish Trap • Overhead Conveyor Systems • Pig Iron • Pipe—API Large Diameter • Rails and Accessories, Standard • Reinforcing Bars and Tie Wire Rock Bolts and Metallic Fabric • Screen, Woven Wire, Industrial, Space, Vibrating • Seamless API Casing and Tubing Semi-Finished and Hot Rolled Carbon Steel • Springs and Formed Wire • Spun and Pressed Heads and Fittings • Steel Plates—Carbon, Alloy, Stainless-Clad, Nickel Plated • Strand and Wire—Prestressed Concrete • Welded Steel Plate Girders Welded Wire Reinforcing Fabric • Wire (All Types) • Wire Rope • Wire Rope Slings • Wire Rods

THE COLORADO FUEL AND IRON CORPORATION

DENVER • OAKLAND • NEW YORK

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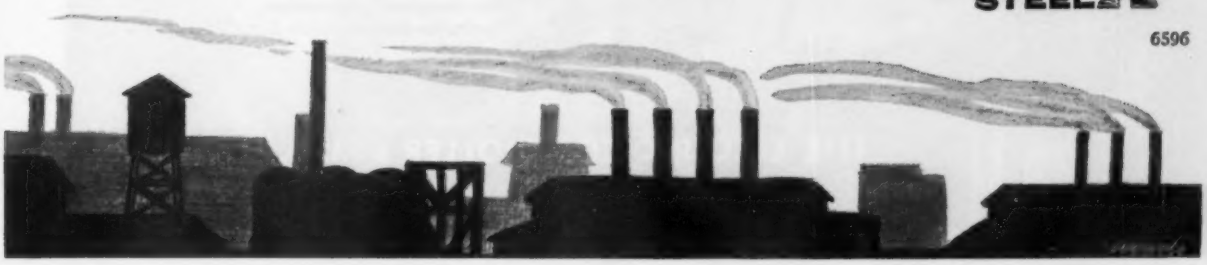
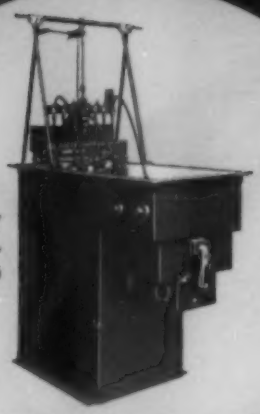


EC&M's LINE OF HIGH VOLTAGE STARTERS GIVES YOU

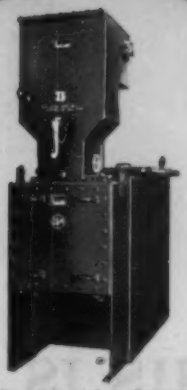
*EXACTLY the Right Starter for Any Location!**

* Hazardous Location, Class I, Group D, Divisions 1 and 2



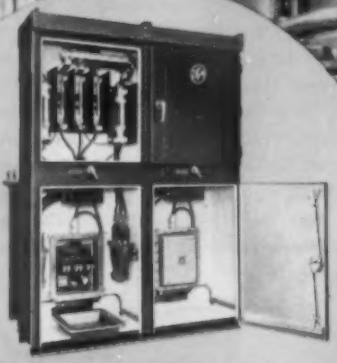
TOTALLY OIL-IMMERSED

Type AT Combination Starter shown with Contactor and Overload Panel raised above the oil level without disconnecting any bolts or leads—in NEMA 3R enclosure for outdoor mounting, available in 50,000 KVA (certified) interrupting capacity.



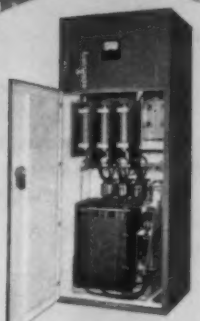
OIL-IMMERSED

Type AM Combination Starter in NEMA 3R enclosure for indoor or outdoor locations—available in 50,000 KVA (certified) interrupting capacity —and VALIMITOR.®



OIL-BREAK

Type AH Combination Starter in NEMA 1 or 3R enclosures for indoor, outdoor or pressurized control room—available in 3 interrupting ratings, 50,000 KVA—POWER FUSED—and VALIMITOR.®



AIR-BREAK

Type AFG Combination Starter for Pressurized Control Rooms. Built in Class E1, Class E2 and VALIMITOR.®

For complete information write for Bulletin 8131-L

THE ELECTRIC CONTROLLER & MFG. CO.

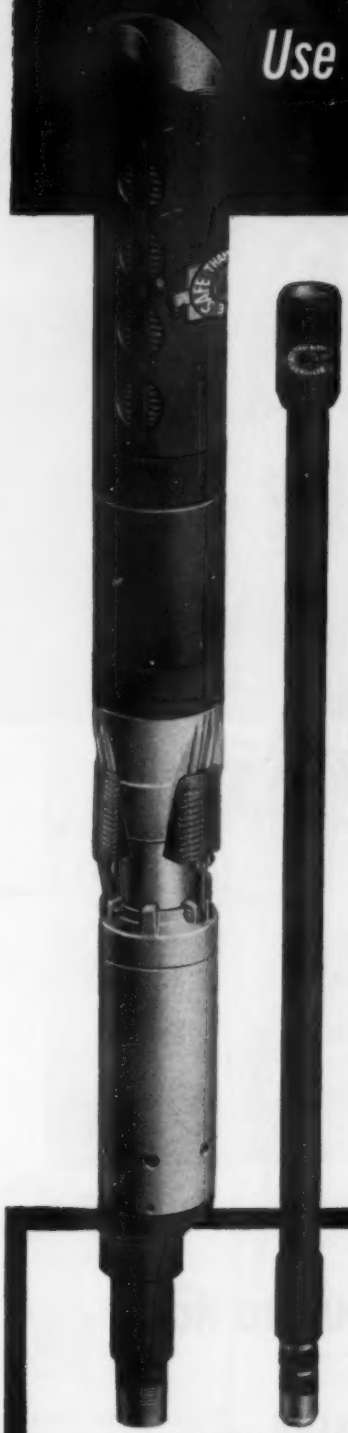
A DIVISION OF THE SQUARE D COMPANY

CLEVELAND 28 • OHIO

7928-R

For Dual String Completions – Flowing or Pumping

Use GUIBERSON'S RETRIEVABLE TYPE RD PACKER



Type RD Packer with Anchor and Plain Stinger

This cleanly designed, rugged packer is an outstanding Guiberson development for dual string installations in wells of any depth.

Outstanding in performance because it operates perfectly with both zones flowing, high or low differential pressure; with either zone flowing, the other zone pumping; with both zones pumping; with either or both zones on gas lift; or for multi-zone injection — gas or water.

Outstanding in advantages because it completely isolates each zone from the other and from the casing; provides full opening long string to lower zone; permits either string to be pulled or run separately.

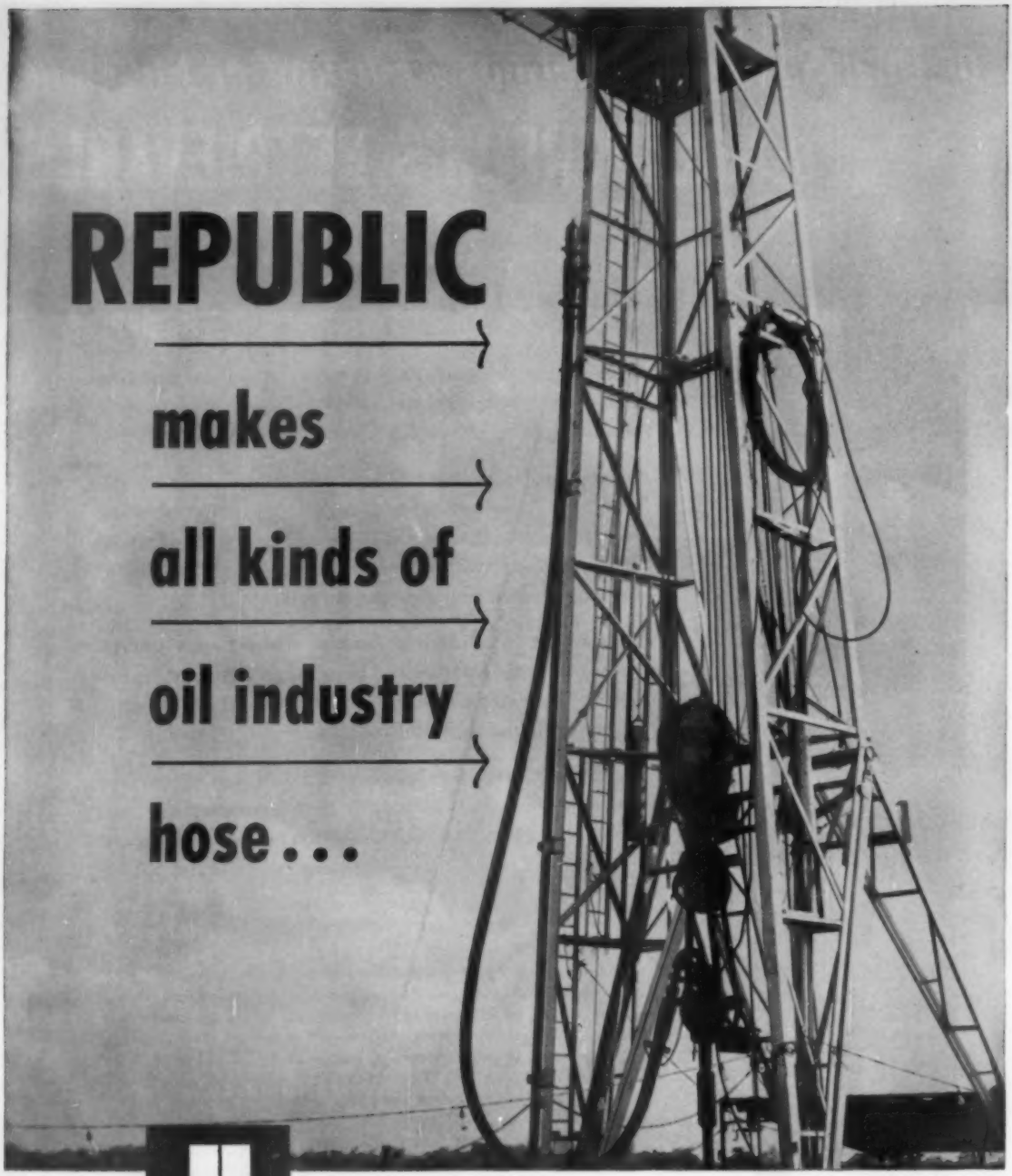
Guiberson's RD packer does complex dual zone jobs so well that operators tell us it's their best investment for dual string production. Ask your Guiberson representative about installation and auxiliary equipment recommendations.

Guiberson's RD packer has smooth operating dovetail slips of heat-treated alloy steel. Packing rubber is one-piece sleeve type — will not vulcanize in the well, made of Guiberson's special oil and gas resistant compound. You can get the RD packer with or without anchor, and a choice of stingers, plain or with snap-ring. Piston slips have extra large gripping area, are heat-treated alloy steel and keyed to anchor body up to maintain proper alignment. Get the Best — Get Guiberson.

THE GUIBERSON CORPORATION

ESTABLISHED 1919 DALLAS, TEXAS U.S.A.

Sold by Oil Field Supply Stores Everywhere



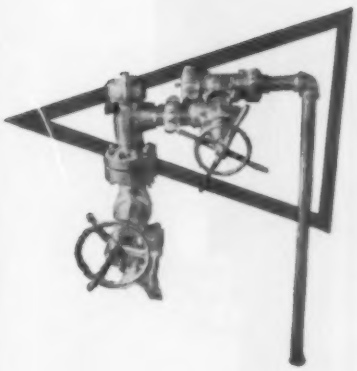
SUPPLY . . . STORES STOCK REPUBLIC HOSE

Stocked in the Mid-Continent Area by
JONES & LAUGHLIN
SUPPLY DIVISION
P.O. Drawer 2481, Tulsa 2, Okla.
and the J & L Store
in YOUR field.

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO
INDUSTRIAL RUBBER PRODUCTS

Stocked on the West Coast by
HENDRIE BELTING & RUBBER CO.
405 Towne Ave., Los Angeles, Calif.
PACIFIC COAST RUBBER COMPANY
51 Main St., San Francisco, Calif.

you can have UNIBOLT FLOW MANIFOLDS any way you like them!

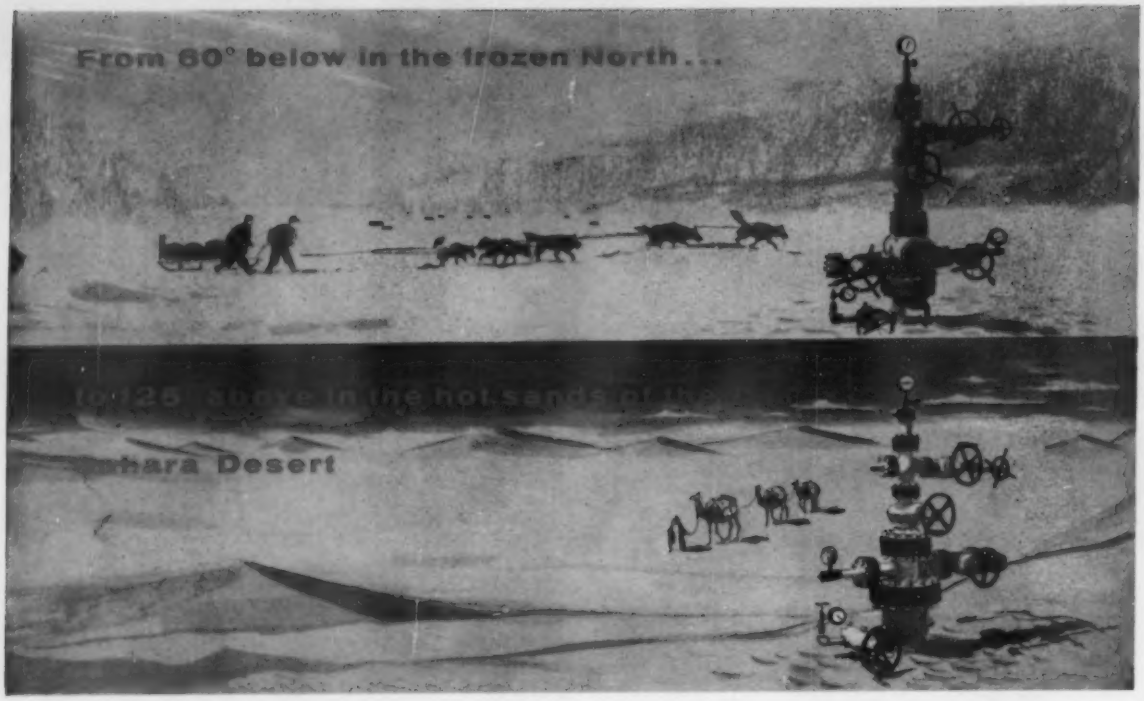


Here are half a dozen of the most popular arrangements of UNIBOLT Flow Manifolds. They range from low-cost, low-pressure threaded connections to low-cost, high-pressure UNIBOLT or API flanged connections. The Wing Valve may also be used as an Adjustable Choke (full open, it passes 10,000 bbls. of fluid per day with only a 100 lb. pressure drop). The Positive Choke Body, or Tee with Cage Nipple and Bean, may be fixed in any plane to facilitate flow line connections. The Wing Valve never needs lubricating and may be completely and inexpensively overhauled in the field. The Positive Choke Body is equipped with a coupling on the downstream end, saving the cost of a flowline coupling. All parts are standard UNIBOLT design, meaning complete interchangeability, and are available thru supply stores everywhere.

Lighter weight but greater strength, lower cost but no sacrifice in quality and all-around usefulness . . . that's the story of UNIBOLT Flow Manifolds.

THORNHILL CRAVER CO.

P. O. BOX 1184 • HOUSTON, TEXAS

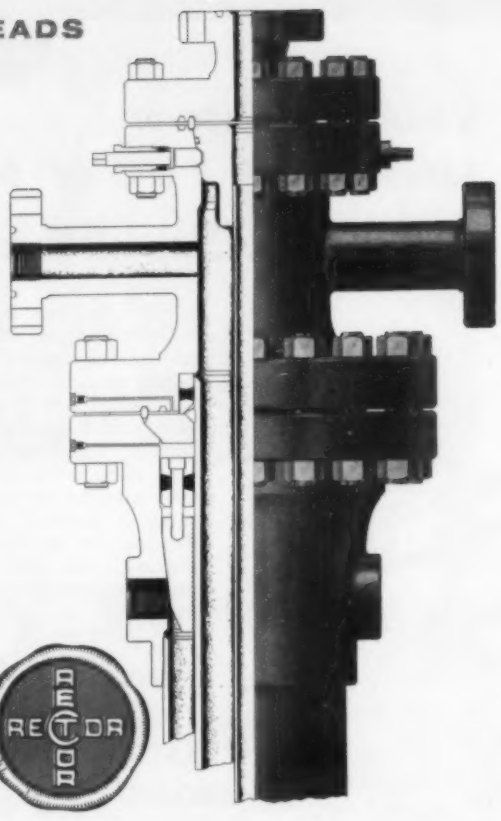


RECTOR

Metal-to-Metal Seal CASING HEADS give the best performance.

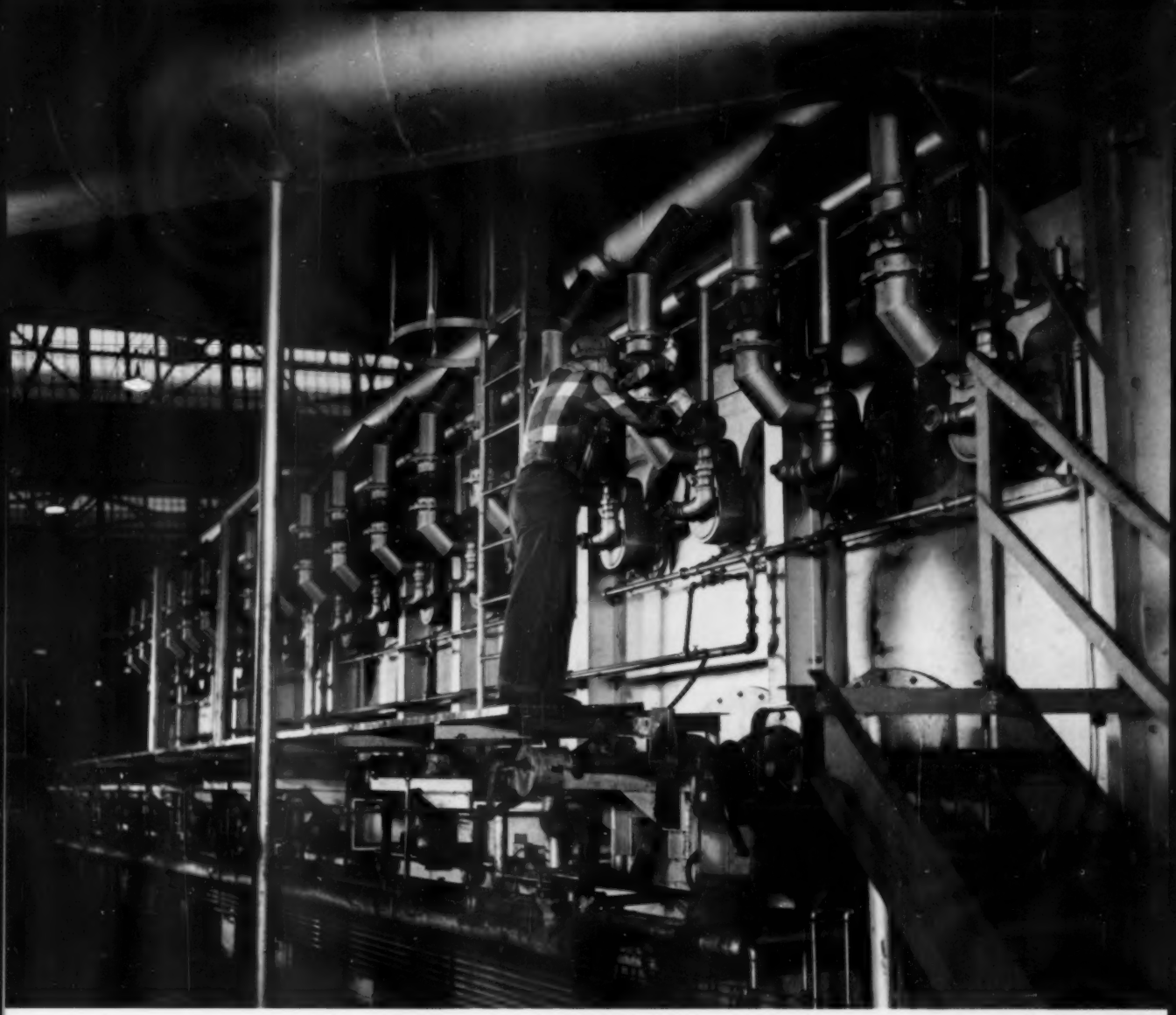
Neither cold nor heat nor humidity can cause a Rector metal-to-metal seal Rectorhead to fail. In temperature ranges from 60° below zero to 850° Fahrenheit Rectorhead continues to out-perform all others. When you use Rectorheads you "seal-with-steel". The welded seal, plus API ring gasket, does not require replacement or maintenance. It is immune to corrosion inhibitors, will not "flow" under high temperatures nor freeze under low temperatures

Specify a Rectorhead and "seal-with-steel". Available in a complete range of sizes up to 20" through your favorite supply store.



CERTIFIED

RECTOR WELL EQUIPMENT COMPANY, Inc.
1100 North Commerce St., Fort Worth, Texas
Houston Plant: 2215 Commerce St.
EXPORT REPRESENTATIVES:
Continental Supply Co., Mid-Continent Supply Co., Oil Well Supply Co.



Side view of National's new 56'3" x 52' walking beam furnace. The action of this furnace insures the most uniform heat possible on SPANG tubular products.

It looks like more SPANG customers to us!

THE NATIONAL SUPPLY COMPANY NSCO

This is the new walking beam furnace installed in our Ambridge, Pa. plant. By handling 35 tons of SPANG tubular products every hour, it substantially increases our tempering and normalizing capacity.

There are many ways to regard a new plant facility. The way we look at it is this: Whether it's a furnace, a tester or any other piece of equipment, more capacity and better control of quality mean an increase in satisfied customers. National's line of SPANG tubular products is the most dependable you can buy.

On the next pages:

SPANG Drill Pipe and Tool Joints

However you measure it,
a SPANG drilling string gives you the best service!

There are three main reasons why SPANG drill pipe consistently outperforms any other—by any standards of measurement:

1. A SPANG drilling string is a fully integrated string.

National Supply is the only company in the industry manufacturing both the drill pipe and the tool joints. From this *single* responsible source, you get a string that has carefully controlled quality from start to finish.

2. SPANG leads in tool joint design—the critical area of pipe service life.

Spangweld Tool Joints are welded to the drill pipe by an automatically controlled operation insuring accurate alignment and a high quality weld. The welding permits a streamlined contour and a reduced number of threaded elements. This tool joint connection also allows the smallest practical O.D. and maximum bore —a definite advantage for slim hole drilling.

Spang Double Seal Shrink Thread Tool Joints can be easily removed and replaced in the field. Joint design has an outer seal, threads and inner seal all on a single cone. This insures uniform, reliable installations both at the mill and in the field, and completely seals against internal and external pressures.

3. SPANG provides the best selective protection against corrosion and abrasion.

Spang Plastic Coating—the result of ten years of research—gives the best protection against corrosion. Scientifically applied at the mill on specially-developed facilities, SPANG Plastic Coating is available not only in SPANG Drill Pipe but also SPANG Casing, Tubing, and Line Pipe.

Spang Hardfacing is a superior protection for tool joints in abrasive formations. It consists of multiple bands of tungsten carbide, *continuously* overlapped on the joint to form a solid particle-to-metal band.

Specific proof of these reasons is furnished every day in numerous locations throughout the world. The National representative in your area will be pleased to tell you more.

SPANG DRILL PIPE—Sizes and performance properties for every requirement

(All properties are based on pipe body)

DRILL PIPE				COLLAPSE			TENSION			INTERNAL PRESSURE		
Size OD	Weight per Foot (Nominal)	Wall	ID	Minimum Resistance Pressure			Minimum Yield Strength			Fibre Stress=87½% of Minimum Yield Strength		
				Grade D	Grade E	Grade G†	Grade D	Grade E	Grade G†	Grade D	Grade E	Grade G†
Inches	Pounds	Inches		PSI			1000 Lbs.			PSI		
2⅞	10.40	.362	2.151	10730	13210	18980	157	214	300	12120	16530	23140
3½	★ 9.50	.254	2.992	—	8080	11610	—	194	272	—	9530	13340
	13.30	.368	2.764	9170	11290	16230	159	272	380	10120	13300	19320
	15.50	.449	2.602	10900	13420	19290	237	323	452	12350	16840	23570
4	★11.85	.262	3.476	—	7080	10170	—	231	323	—	8590	12040
	14.00	.330	3.340	7380	9080	13060	209	285	400	7940	10830	15160
4½	★13.75	.271	3.958	—	6280	9030	—	270	378	—	7900	11070
	16.60	.337	3.826	6760	8310	11950	242	331	463	7210	9830	13760
	20.00	.430	3.640	8420	10370	14910	302	412	577	9200	12540	17560
5	★15.00	.296	4.408	—	6130	8810	—	328	459	—	7700	10880
	19.50	.362	4.276	6550	8060	11590	290	396	554	6960	9500	13300
5½	21.90	.361	4.778	5770	7100	10200	321	437	612	6320	8620	12060
	24.70	.415	4.670	6800	8370	12040	365	497	696	7260	9900	13860

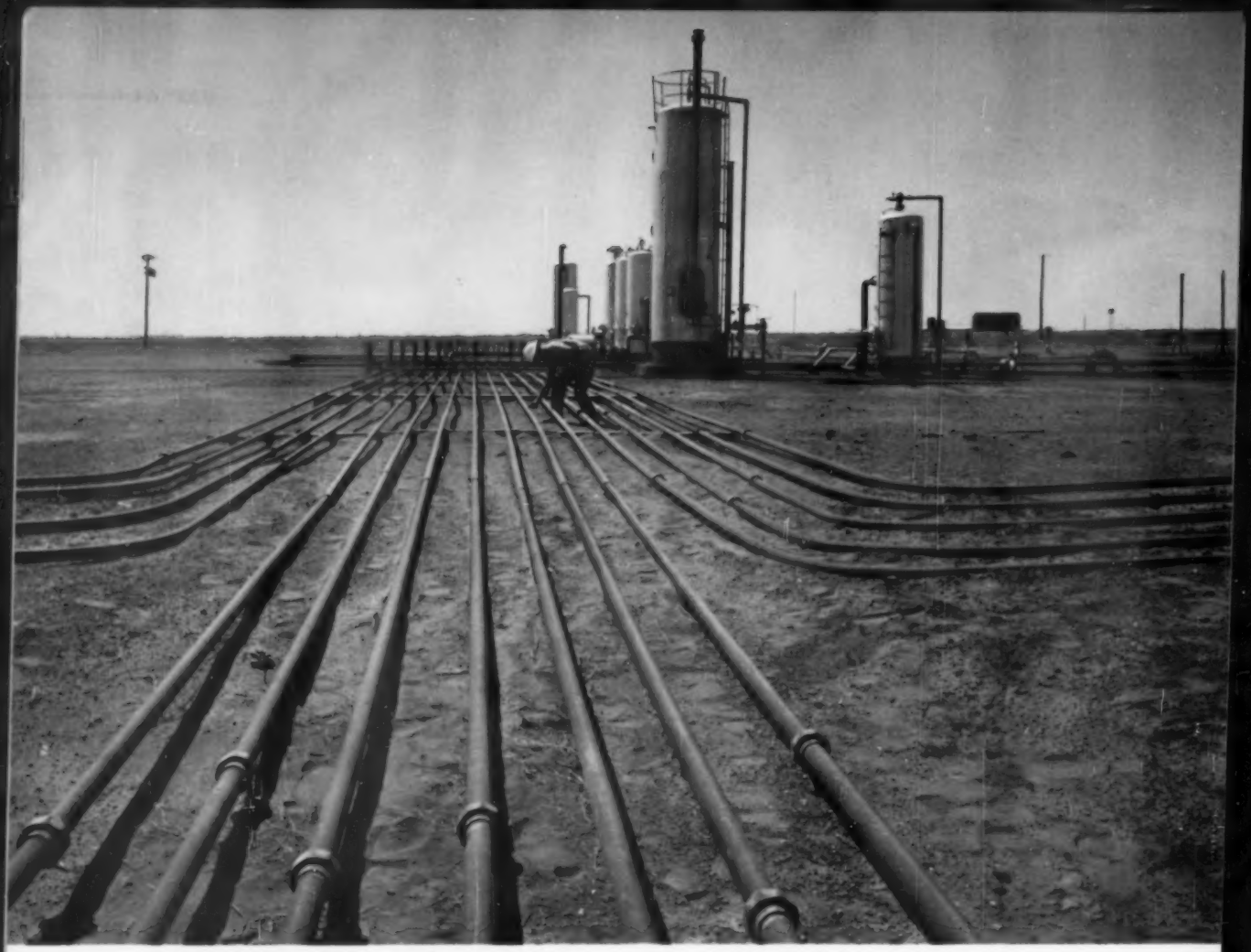
★Weights are listed as tentative by API. †Grade G is 105000 psi Minimum Yield Strength Material

A show the whole world should see!

International Petroleum Exposition

TULSA, MAY 14-23 . . . Don't miss it!

More on the next page . . .



Gathering line service is one of the many oil field applications for dependable SPANG CW Steel Pipe. In addition to gas, oil and water lines, you can use it for roof rails, step rails and many other structural purposes.

There's no premium price for the special quality of SPANG CW STEEL PIPE!

Careful manufacturing control is the main reason why SPANG CW is your best selection for a wide variety of piping installations.

Rigid tests and inspections during manufacturing and before shipping guarantee long service life for SPANG CW Pipe. Every length of SPANG CW Steel Pipe is hydrostatically tested and inspected for thread quality and uniformity. The result is that you get a stronger, more durable pipe with cleaner welds and smoother finishes —inside and outside.

The best part is that you pay no more for this special quality. All sizes of SPANG CW—plain end, or threaded and coupled—are readily available through your nearest National Supply Store. Order now for your next job!

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

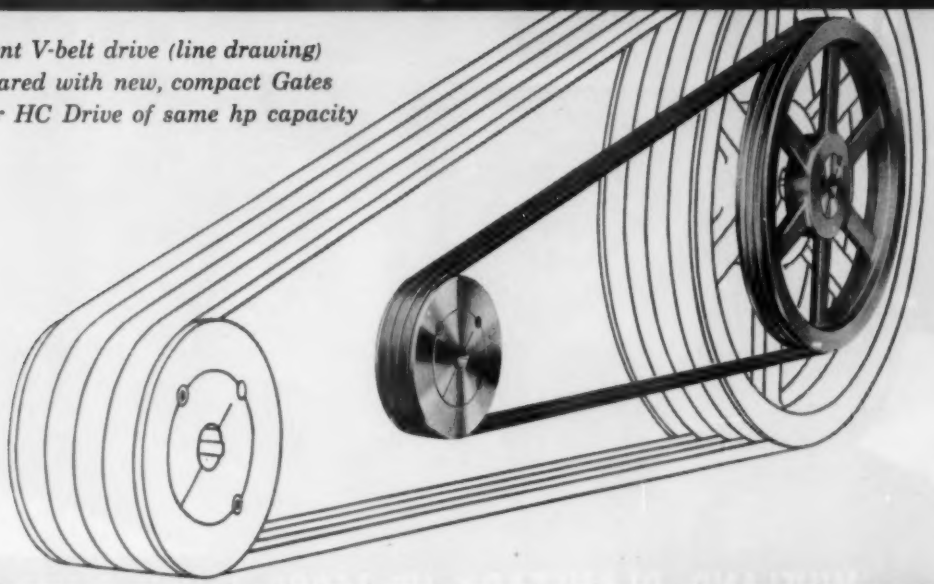
TWO GATEWAY CENTER, PITTSBURGH, PA.

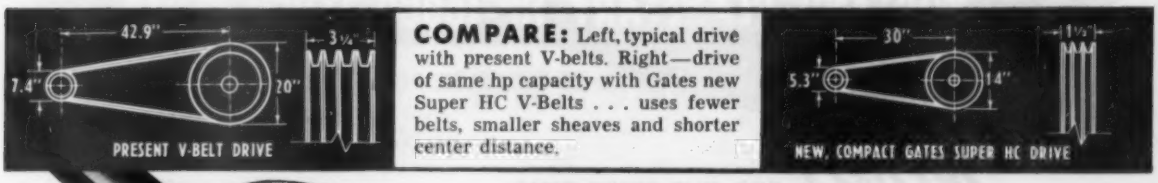
DIVISION OFFICES: Calgary, Dallas, Denver, Houston, Toledo, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C.1

up to 50% LESS SPACE needed for revolutionary new V-belt drive

Present V-belt drive (line drawing) compared with new, compact Gates Super HC Drive of same hp capacity





COMPARE: Left, typical drive with present V-belts. Right—drive of same hp capacity with Gates new Super HC V-Belts . . . uses fewer belts, smaller sheaves and shorter center distance.

Exclusive cross-section design: The precisely engineered arched top, concave sidewalls (U. S. Pat. 1813698) and special tensile construction insure full pulling power and longer belt life.

Reduces drive cost as much as 20%

A major advance in the field of power transmission, the fully proved Gates Super HC V-Belt, makes possible the lowest-cost, lightest-weight, most compact multiple V-belt drive that can be put on any machine!

The cost of a new Gates Super HC V-Belt Drive is as much as 20% less than present V-belt drives of the same hp capacity.

For detailed information on the Super HC Drive, contact your nearby Gates distributor or Gates Office for new booklet, *"The Modern Way to Design Multiple V-Belt Drives."*

TPA 389

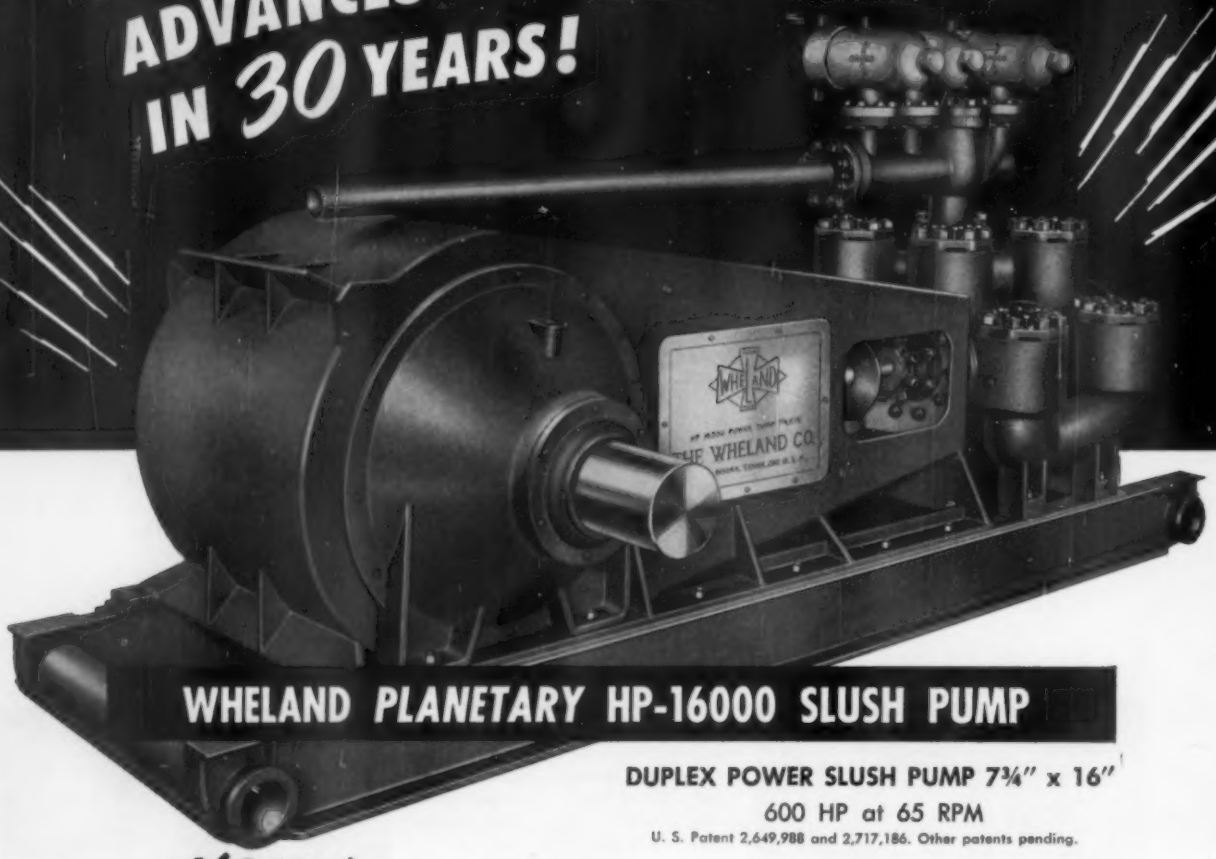
The Gates Rubber Company, Denver, Colorado

Gates Rubber of Canada Ltd., Brantford, Ontario

World's Largest Maker of V-Belts

Gates Super HC V-Belt Drives

MOST IMPORTANT ADVANCES IN PUMP DESIGN IN 30 YEARS!



WHELAND *PLANETARY* HP-16000 SLUSH PUMP

DUPLEX POWER SLUSH PUMP 7¾" x 16"

600 HP at 65 RPM

U. S. Patent 2,649,988 and 2,717,186. Other patents pending.

NOW! **FOR THE FIRST TIME . . .**

these proven mechanical principles are applied to a slush pump!

SEE OUR EXHIBIT

MAY 14-23, 1959
Tulsa, Oklahoma

- **PLANETARY GEAR SYSTEM**
  with gear cartridge assembled and inserted as a unit.
- **CROSSHEAD IS A PERFECT CIRCLE**
  thus stays perfectly aligned in every direction.
- **FLOATING INPUT SHAFT**
  with unique sheave mounting which lets shaft transmit torque load ONLY.

Three years in designing, developing and in final field testing are behind this newest, most advanced WHELAND 16" PUMP. A folder giving the highlights of this new pump is yours for the asking . . . or we can give you current locations so you can see it in operation. You can't afford to buy any pump in this size until you've seen this new Wheland pump!

WHELAND

ROTARY DRILLING MACHINERY

THE WHELAND COMPANY

CHATTANOOGA, TENNESSEE, U.S.A.

DRAW WORKS • SLUSH PUMPS • ROTARIES
CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS

DOMESTIC DISTRIBUTORS: INDUSTRIAL SUPPLY COMPANY, INC.—Main Office: Wichita Falls, Texas • HOUSTON OIL FIELD MATERIAL COMPANY, INC.—Main Office: Houston, Texas • JONES AND LAUGHLIN STEEL CORPORATION, SUPPLY DIVISION—Main Office: Drawer 2481, Tulsa 2, Oklahoma.

EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.

They Say—

Mixup on Suez opening date

Dear Sir:

I want to congratulate you on the splendid job you and your associates have done in producing Petroleum Panorama. It is proving to be a great help to me in my work here at the American Petroleum Institute.

However, I should like to question the statement made on page A-15 and to have it clarified for my own information and guidance.

The opening sentence of the fifth paragraph on that page reads, "The Suez Canal was opened for navigation in 1892. . ." Actually, the canal was opened in November 1869, according to the record.

Henry La Cossitt
Editorial Consultant
API Centennial Committee
New York

(Editor's note: Reader La Cossitt is correct. The Suez Canal was opened for navigation in 1869. It was closed to bulk shipment of oil or petroleum products until 1892, however, because of a general fear of explosion or fire. The statement should have read that the Suez Canal was opened for tanker navigation in 1892.)

Tidewater within quota

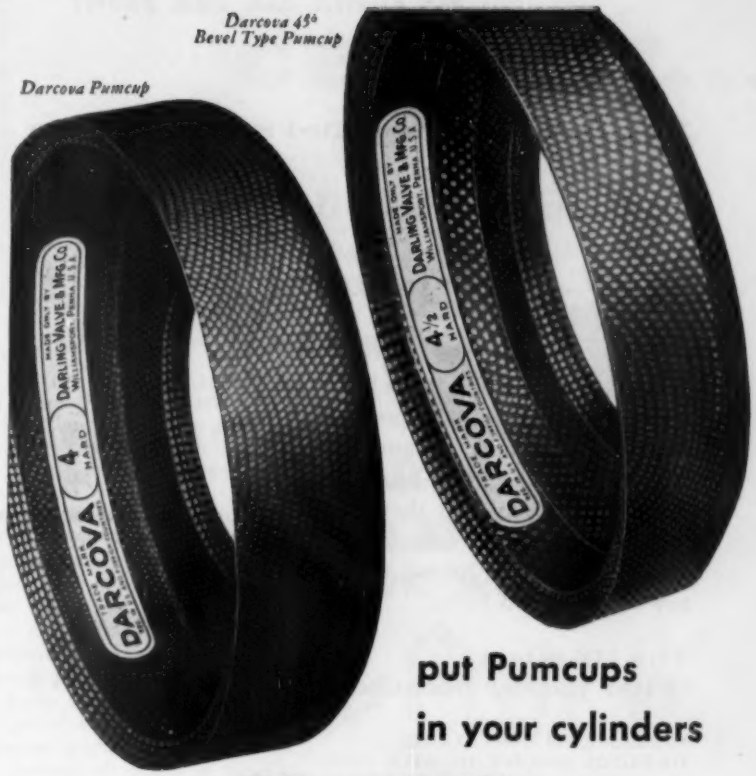
Dear Sir:

On page 74 of the February 23 issue . . . is this remark, "Tidewater Oil Co., which frequently has exceeded its quota under voluntary controls . . . "

As a matter of record, Tidewater has always been in compliance in the West and also in strict compliance in the East since February 1, 1958. We have been slightly under our quotas as of July 1, 1958, and January 1, 1959. We have even established the practice of holding ships offshore or placing oil in bond in order to remain in strict compliance.

As you may be aware, the voluntary plan calls for importing a maximum number of barrels per day on a 3-month average running basis. Therefore we have not always imported in the same volume each month, and during some months the amount has been much greater than the quota.

We got into such a cycle in the East by making our compliance there retroactive to February 1, 1958, when we were forced to comply in April 1958. We had previously imported volumes in excess of the quota in February



put Pumcups in your cylinders

TO HOLD PRESSURE LONGER!

In Darcova Pumcups a sound engineering principle has been combined with precision tolerances and extremely durable compositions to provide exceptional efficiency and life in hydraulic, air, and reciprocating pump cylinders of all kinds.

Unlike ordinary piston packing, precision Pumcups are engineered to minimize friction load while hugging cylinder walls on every pressure stroke. Regardless of eventual wear, efficiency *stays* high! So there's far less down-time and need for replacement.

Pumcups are made in a wide range of sizes, types and texture-engineered compositions, including 100% Nylon, for all kinds of pressure-temperature-fluid conditions. Send for Pumcup Bulletin 5503 and weigh all the facts!

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

Safe Sure Simplified Setting with the

Brown HS-8 Hydraulic Set Retrievable Packer

Demands today call for deeper hole, higher pressure, and more production. Whether single or multiple completions are required, Brown is ready to help you meet the situation. The job will be easier, safer, and more profitable for you with a new Brown HS-8 Packer.

The HS-8 is a better packer because:

WELLHEAD INSTALLED BEFORE PACKERS ARE SET. The well may be kept under positive control at all times since the wellhead is put into place before the drilling fluid is displaced or packers are set.

PRODUCTION ZONES CAN BE WASHED AFTER WELLHEAD IS INSTALLED. Before packer is set, complete circulation and cleaning of producing zones can be accomplished.

CONTACT WITH CASING UNNECESSARY. Conventional drag springs or friction blocks are not used. Packers may be run in rapidly—mud bypasses easily.

TUBING STRINGS FOR EACH PRODUCTION ZONE. This feature eliminates concentric string flow. Tubing may be spaced out and connected between duals or triples while running in the hole, thus eliminating guess work. The hazard of running a string of tubing through a packer is eliminated.

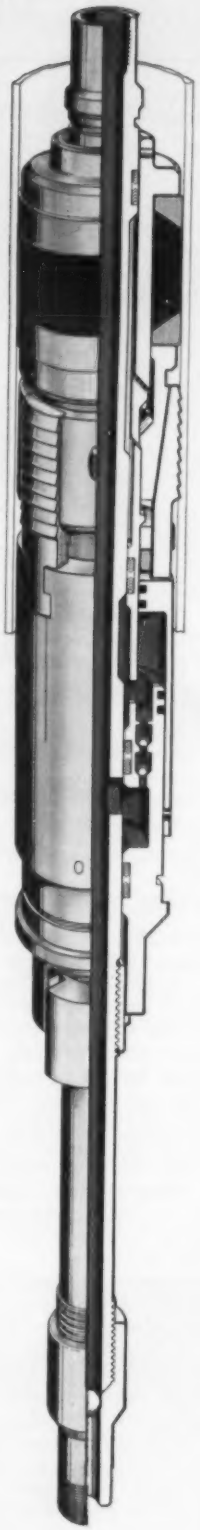
HYDRAULIC PRESSURE SETS THE PACKER. Hydraulic pressure performs a double action, setting slips and seal in sequence at the proper depth in the hole.

LANDED TUBING REMAINS IN NORMAL TENSION. The tubing is landed in normal tension, that is, tension due to its own weight. No tubing movement occurs in the setting procedure. Therefore, the tubing is left in neither compression nor added tension. This results in a straight tubing string which is essential in wire line work. Large diameter packers may be set at shallow depths since tubing weight is not a factor in setting the packers.

ALL HS-8 PACKERS ARE SET INDIVIDUALLY. Multiple HS-8 packers may be set in sequence for selective zone washing or treatment. This eliminates annulus pressure and makes possible increased production.

RETRIEVING WITH POSITIVE MECHANICAL RELEASE. Packers may be released by right-hand rotation of tubing, thus eliminating any need for left-hand rotation to either set or release them. A jaw-clutch arrangement built into the packer is used as a rotary jar to assist in retrieving the packer after the hydraulic pressure has been released from the cylinder. Retrieved packers may be serviced and re-used.

Brown Hydraulic Set Retrievable Packers are now available in a complete line of standard casing sizes for single, dual, triple, and quadruple string completions.



Call your nearest Brown representative for the smoothest settings ever. We have a new brochure on the HS-8 Packer, which we will be happy to mail at your request.

BOT

BROWN

OIL TOOLS, INC.

8490 Katy Road, Houston, Texas

and March. By dropping low in April we were able to establish a 3-month average within the quota for the East. We have maintained the same schedule since and generally have two big months followed by a small one.

This cycle has evidently caused some members of the press to erroneously assume that Tidewater has not been in compliance. I thought the Journal was more astute and was surprised to see that you have picked up this unfounded rumor.

We feel that the import control plan is inequitable and it has cost us a lot to comply. Please, do not add insult to injury!

James McDonald
Administrative Manager
of Manufacturing
Tidewater Oil Co.
Los Angeles.

Lightning struck twice

Dear Sir:

I would like to add my compliments on your Panorama. It contained a great deal of information.

However, as an interested historian, I was a little bit disappointed that it did not contain more historical narrative. There are a great many very interesting sidelights in the history of the oil business, such as the fact that John Wilkes Booth's oil well in Pennsylvania was struck by lightning and the rig destroyed on the night (at approximately the very moment) that he shot Lincoln.

Little things like this add spice to the story of oil and I am hopeful that before the year is over, publications of this type will be forthcoming.

Clarence B. Folsom, Jr.
Chief Petroleum Engineer
North Dakota Geological
Survey
Grand Forks, N. D.

Isolationist talk must go

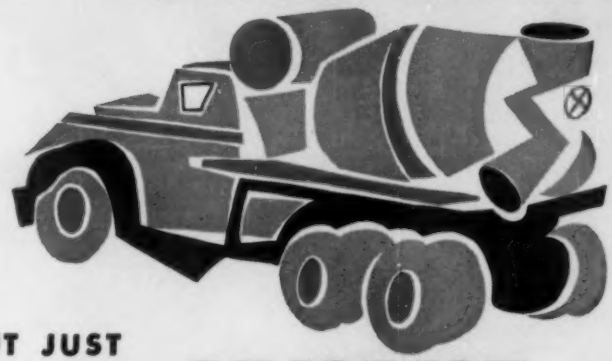
Dear Sir:

The letter of Benjamin A. Lambert in regard to India's oil production and cooperation with the West ("They Say," Feb. 9, p. 43) is an extremely timely one. Mr. Lambert has, it seems to me, done a great service for readers of The Oil and Gas Journal in stressing great differences between our form of democracy and that of the Indian Government.

His letter serves again to point out that the "home folks" are letting foreign competitive skills get the better of American know-how when it comes to being alert to what goes on abroad.

At the moment it does not matter to argue whether the Russians are purposely underpricing their exported products or not; the matter is, as it

THERE ARE ALL KINDS OF
CEMENT...



BUT JUST ONE BEST CEMENT ADDITIVE FOR OIL WELLS!

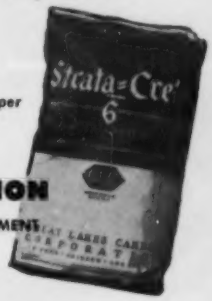
ONLY Strata-Crete 6* ® TRADE MARK

GIVES YOU ALL 6!

* Lower Cost — this improved perlite cement slurry actually costs less, generally, than the fillup cost of neat cement!
* Easier Placing — Strata-Crete 6 cement slurries require only normal pump pressure, even in slim holes and deep wells!
* Complete Fillups — superior bridging qualities, plus light weight, assure your best chance for complete fillup to desired height!
* Cleaner Perforating — greater resiliency of Strata-Crete 6 has been proved to reduce fracturing and shattering!
* Versatility — Strata-Crete 6 is not limited for use with any type or brand of cement. It is insoluble in crude oil and acid, and gives added resistance to attack by sulphates.
* Resistance to High Well Temperatures — Strata-Crete 6, itself, is not affected by high temperatures encountered in many deep wells!

Strata-Crete 6 can be obtained from your oil well cementing service company.

* *Refers to gallons of water required per cubic foot of Strata-Crete 6*



GLC

GREAT LAKES CARBON CORPORATION
MINING & MINERAL PRODUCTS DIVISION — STRATA PRODUCTS DEPARTMENT
1404 NIELS ESPERSON BUILDING
HOUSTON 2, TEXAS

About Electro-Motive Power on Movible No. 2—

Control center is located beside draw works. D. W. Goodyear, driller, stands beside Electro-Motive control console that provides complete control of all Diesel-electric equipment.

Movible Offshore Company Rig No. 2 as it looked in November in West Cameron Area. Rig was launched in September 1957. Platform is designed to drill in depths up to eighty feet. Submersible structure measures 200′ by 200′.

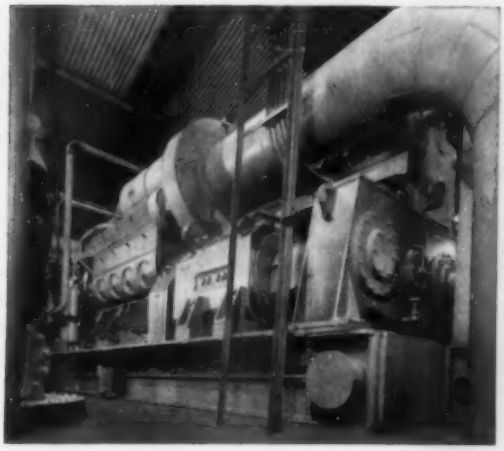
"IT'S GOT THE FEEL OF STEAM...PLUS ONE COMPANY SERVICE"

In less than fifteen months time, Movible Offshore's Rig No. 2 has drilled an impressive 90,000 feet of hole. Though superintendent R. L. "Ray" Meadows is an old steam man, he has this to say about Electro-Motive Power: "It's got the feel of steam, it's flexible and has all the reserve extra power needed for any emergency".

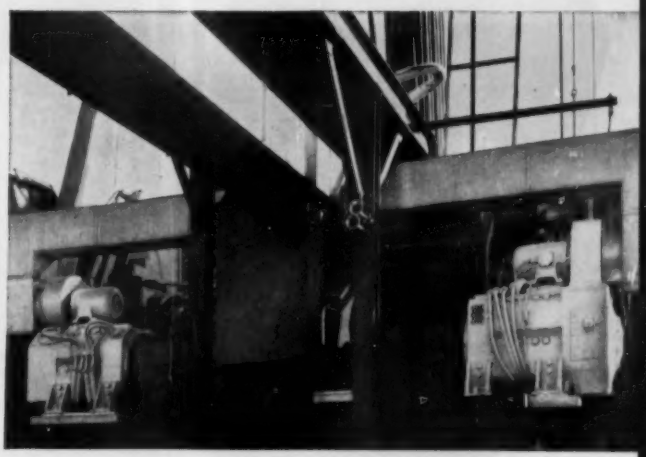
When Ray Meadows refers to "one company service", he means that Electro-Motive is responsible for the complete power system. One source for service and parts on both engine and electrical components.

Probably the most valuable part of Electro-Motive service is what Ray calls "willingness to help". In one instance, an idea by Movible with an assist from Electro-Motive effected a substantial cost savings.

Before you decide on any drilling power, see your Electro-Motive representative. Let him tell you about this equipment. After that, you will know why more offshore rigs use Electro-Motive Power than any other Diesel-electric system.



Engine room on Movible No. 2 is compact and neat. Three Electro-Motive engine sets, each driving two d.c. generators, supply power to drive all motors. Current Electro-Motive model SR-10 is rated at 1,000 horsepower.



Two Electro-Motive drive motors are used to power the draw works. Similar drive motors are used on mud pumps and rotary. Interchangeability of parts between all drive motors and generators provides savings on maintenance and service.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS • *In Canada:* **General Motors Diesel Limited,** London, Ontario

Petroleum Industry Sales Offices: Houston, Texas; Los Angeles, California

DIRECTIONAL DRILLING • FISH TTING • ELECTRICAL WELL SERVICES • OILFIELD SUPPLIES • EXPORT TOOLS & SERVICE

THE HOMCO WASHOVER BACK-OFF CONNECTOR RECOVERS THE PIPE

HOMCO
Fishing, Cutting and Electrical Well Service

Affords less rig time

Aids in the recovery of more pipe

Safe
Economical
Dependable

The HOMCO Washover Back-Off Connector is designed to safely increase the rate of recovery of stuck drill pipe or tubing in washover operations.

The basic function of the connector is to enable the operator to washover and back-off with the string shot, recovering the "fish" with one round trip of the drilling string, thus saving rig time.

On an actual fishing job, through the use of the HOMCO Washover Back-Off Connector and HOMCO String Shot, only seventeen trips were necessary to recover 9,188 feet of pipe. A total of 207 hours of rig time was used. Without the use of the HOMCO Washover Back-Off Connector and String Shot a total of 34 trips would have been required and 412 hours of rig time would have been used to accomplish the same job.

research
engineering
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HOMCO
HOUSTON OIL FIELD MATERIAL COMPANY, Inc.

WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION

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MEXICO CITY, MEXICO
LONG BEACH, CALIFORNIA
MARACAIBO, VENEZUELA
PARIS, FRANCE

WRITE FOR TECHNICAL BULLETIN NO. 27-1-1

seems to me, they have the goods and go after the business.

The time is past for us to sit idly by and criticize this or that nation for its form of government. Many of these nations want exactly the kind of government they have. Be kind to these people, stop teaching western superiority, and come forth with this American know-how and skill which we know works well for us.

Trade is the life-blood of nations. So let's get going and stop isolationist criticism.

E. J. Barth
Consultant
New York.

Booklet of facts might help

Dear Sir:

I am concerned about the ever mounting tax load that the petroleum industry is having to bear. It is well known that right now both state and national governments are working overtime trying to impose additional taxes on the already over taxed oil business. In addition there are people who would reduce the depletion allowance. The industry seems to be singled out for a bad time taxwise.

In my opinion, The Oil and Gas Journal has done more for the industry than any other similar publication. I hope you will keep after the people who would impose these extra tax burdens.

Along with a recent bill from the telephone company came a little booklet on the telephone tax. I am sure that everyone who has a telephone got one, as it is no doubt a national effort to try to get the telephone tax reduced.

It is my thought that if the oil industry would make a similar effort with their customers, it might augur well for at least no more tax increases. The facts in a little booklet form could be sent along with every royalty check, every production check, and with bills to credit-card holders.

Giles L. Glazener
Lubbock, Tex.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

MARCH

16-18 Western Petroleum Refiners Association, forty-seventh annual meeting, Hilton Hotel, San Antonio, Tex.

16-19 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, forty-fourth annual meeting, Memorial Auditorium, Dallas.

16-20 National Association of Corrosion

STRAN-STEEL BUILDINGS—NOW IN COLORS!

Stran-Steel Rigid Frame structures have no interior columns. From wall-to-wall and ceiling-to-floor their wide open interiors are 100% usable.

MODERN PLANT CONSTRUCTION AT ITS FINEST

Fashionable as well as functional, these all-steel buildings are available in six rich Stran-Satin Colors: blue, bronze, green, gray, rose and white. Factory-applied Stran-Satin Color coatings of vinyl-aluminum are baked on over zinc-coated steel. Stran-Steel's rugged construction assures you of today's best all-around buy in industrial and commercial buildings. You specify the size and layout you want—custom-tailoring is a specialty with Stran-Steel. Only 25% initial investment and five years to pay on Stran-Steel's purchase plan. For full details, mail coupon or contact your Stran-Steel dealer. He's listed in the Yellow Pages under *Steel Buildings* or *Buildings—Steel.*

LOW-COST STRAN-MASTER: The fireside Stran-Master, lowest cost all-steel building, is also available in Stran-Satin Colors. Yours for only a few hundred dollars down.

Stran-Steel

DEALERS EVERYWHERE

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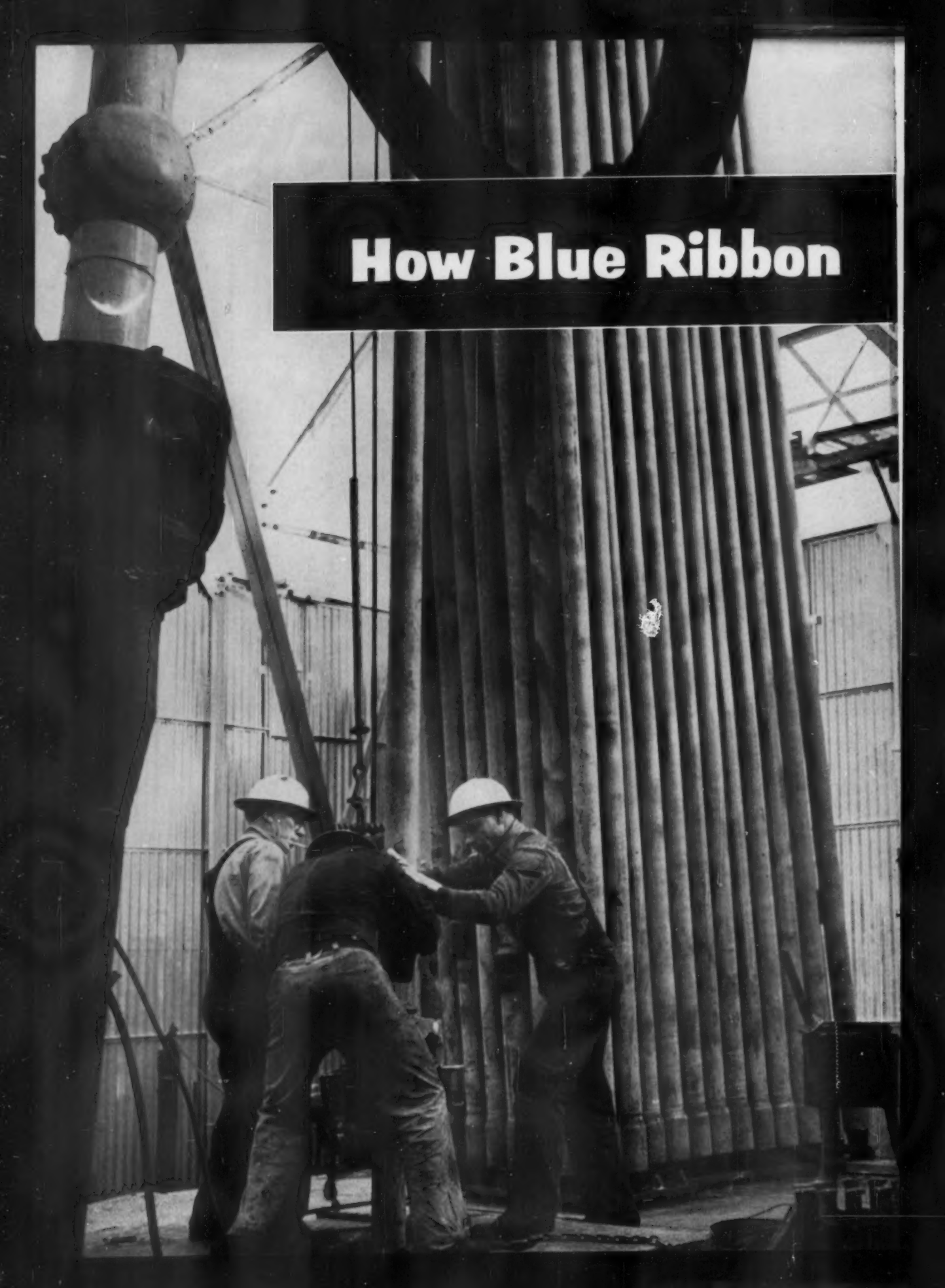
Detroit 29, Michigan • Division of
NATIONAL STEEL CORPORATION

Stran-Steel Corporation, Dept. OGJ-7
Detroit 29, Michigan

Please send data on Stran-Satin Color and complete literature on industrial buildings.

Name_____
Title_____ Phone_____
Company_____
Address_____
City_____ Zone____ State____


How Blue Ribbon

Sets Drilling Records

When made of **Blue Ribbon** heat-treated alloy steel, or **Blue Ribbon Vanadium, J&L Drill Pipe** digs the world's deepest wells. Records for greater economy and over-all efficiency are established every day by **J&L Drill Pipe.**

There are built-in reasons — indestructible reasons — for the better performance of **Blue Ribbon.** These reasons begin at the iron ore mine and multiply through every guarded, tested step in mill and finishing processes. They are integral with the steel itself — and J&L is a great name in steel.

J&L Supply service, alert and capable, completes a drill pipe package contractors like. It assures improved performance from a major investment.

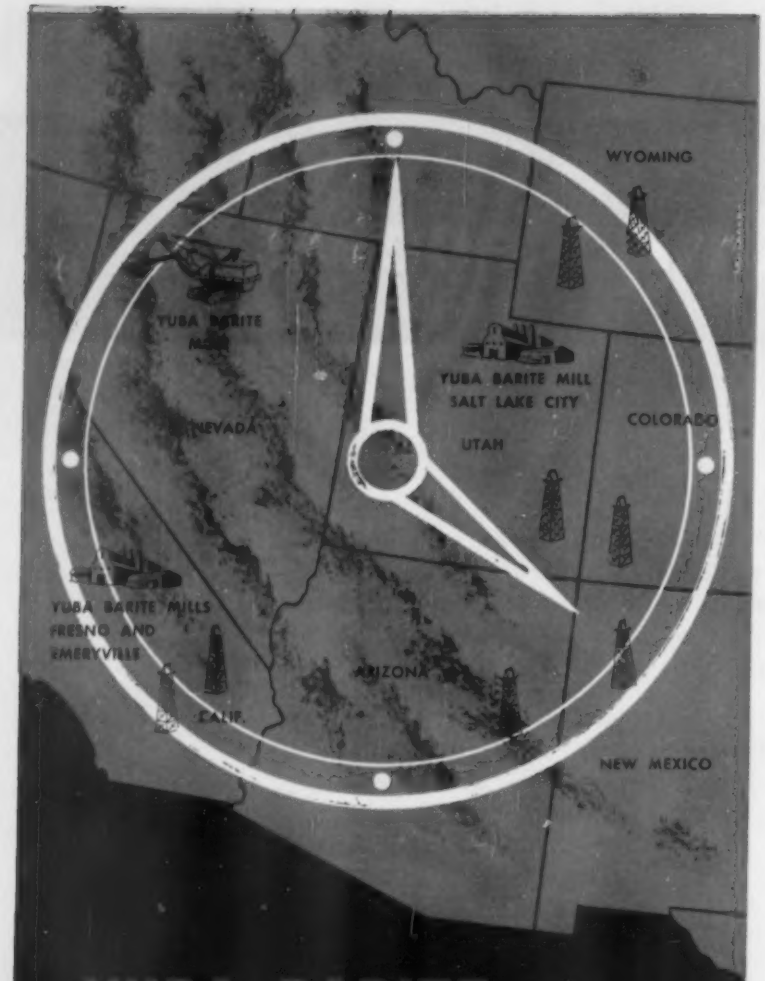
J&L Drill Pipe is made in sizes and grades to meet the requirements of careful management in planning wells to any depth. It is upset for grip type, counterbore weld and flashweld tool joints.

For pertinent technical data, contact any J&L Supply man or write us at Tulsa — Drawer 2481.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available



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Yuba Barite, with around-the-clock availability, assures efficient utilization of your drilling rig. Its natural 4.2 specific gravity makes it the ideal choice in any drilling operation requiring a maximum weight mud.

The Yuba Barite mines in Nevada, through strategically located mills in Salt Lake City, Utah, and Fresno and Emeryville, California, assure generous, dependable supplies for immediate delivery to drilling locations in the Four Corners, Wyoming, and the Pacific Coast.

Your experienced Yuba Distributor will be glad to assist you with your specific mud problems.

YUBA MILLING DIVISION

METALS DISINTEGRATING COMPANY, INC.

General Offices, Dept. B, Elizabeth B, N. J.

Salt Lake City, Utah • Emeryville, California • Fresno, California

Engineers, fifteenth annual conference, Hotel Sherman, Chicago.

17-18 Manufacturing Chemists' Association, air and water-pollution abatement conference, Netherlands Hilton Hotel, Cincinnati.

18 Petroleum Equipment Suppliers Association, eastern district, annual membership meeting, Duquesne Club, Pittsburgh.

19 Independent Oil Producers and Land Owners Association, Tri-State, annual meeting, McCurdy Hotel, Evansville, Ind.

19-20 New England Gas Association, annual meeting, Hotel Statler, Boston.

21 North Texas Oil and Gas Association, twenty-ninth annual meeting, Kemp Hotel, Wichita Falls, Tex.

23-24 University of Oklahoma, second conference on theory of fluid flow through porous media, Norman, Okla.

25-27 American Petroleum Institute, Division of Production, southern district meeting, Roosevelt Hotel, New Orleans.

26-27 Southern California Meter Association, eighth annual instrument short course, Los Angeles Harbor Junior College, Wilmington, Calif.

31 Seventh annual meeting, Philadelphia-Wilmington section of American Institute of Chemical Engineers, and University of Pennsylvania, Philadelphia.

29-Apr. 2 American Society of Mechanical Engineers, instruments and regulators division conference, Case Institute of Technology, Cleveland.

APRIL

2-3 Society of Petroleum Engineers of AIME, Rocky Mountain petroleum section, Casper, Wyo.

2-3 American Institute of Mining, Metallurgical, and Petroleum Engineers, technical conference on stress corrosion, Mellon Institute, Pittsburgh.

2-4 Society of Economic Paleontologists and Mineralogists, Permian basin section, annual meeting, Roswell, N. M.

2-6 Geological Society of America, Cordilleran section, annual meeting, University of Arizona campus, Tucson.

5-10 Engineers Joint Council, nuclear congress, Cleveland Auditorium, Cleveland.

5-10 American Chemical Society, national meeting, Boston.

6-7 Instrument Society of America, second national symposium on chemical and petroleum instrumentation, St. Louis.

7-8 Sixth Gas Compressor Institute, sponsored by University of Kansas and Southwest Kansas petroleum industry, Randall's Cafeteria, Liberal, Kans.

8-9 Western Petroleum Refiners Association, computer conference, Hotel Tulsa, Tulsa.

8-10 American Petroleum Institute, Division of Production, eastern district meeting, Penn-Sheraton Hotel, Pittsburgh.

14 Independent Oil Men's Association of New England, annual meeting. Hotel Statler, Boston.

14-16 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

15-17 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

15-17 American Petroleum Institute, Division of Transportation, annual tanker

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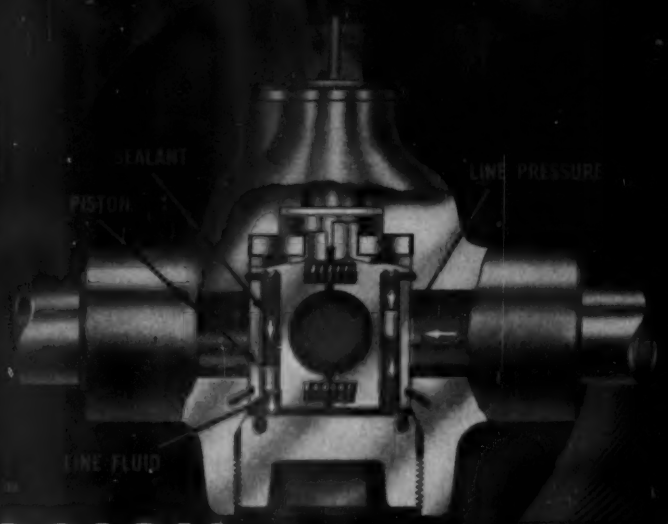

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Why? Because line pressure forces Mission Sealant through two semi-circular grooves around the downstream port, sealing like a plastic packing, to form a gas-tight seal. Leaks are stopped automatically before they start.

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59—2 01

3 Store Managers Work Triple Play To Help Return Rig To Operation

Hurry-Up Call For Casing Demonstrates How Pittsburgh Steel Company's Independent Distributors Go All-Out To Help Drilling Crews

Casing has been run, drill pipe is back on rack and A-mast rig stands stark against Texas sky while concrete sets.

Three oil country store managers for a Pittsburgh Steel Company independent distributor teamed up to put a North Texas oil well rig back in operation after the coldest weather in 20 years forced a shutdown.

With water lines frozen and the sludge-pit covered with ice during the cold weather, the drilling contractor was forced to suspend operations. When he was notified of a coming break in the weather, he moved fast to avoid any more lost drilling time.

At 5 a.m., his tool pusher called the independent distributor's store in Wichita Falls, Texas, and asked Store Manager Pete Kovack for 3,500 feet of 5½-inch Pittsburgh Steel Co. casing. Kovack promised action. Kovack called his home office in Fort Worth. Headquarters immediately made a telephone survey of casing stocks at stores in Olney and Graham, Texas, the two closest stores to the rig located in the Young County Regular Pool.

• **Adequate Stocks on Hand**—The telephone check disclosed that Graham, the closest store, had adequate stocks. So Graham Store Manager Leon Mangum roused warehousemen and truck drivers who loaded two trucks with the 3,500 feet of casing. The casing was on the racks at the rig by 8 a.m. long before it was needed by the tool pusher. Work continued without any new delays. Tool Pusher Jesse Johnson, whose company has used more than 70 strings of casing bought from this distributor, said the casing was run in six hours without trouble of any kind.

The driller ran Pittsburgh Steel's J-55 API standard casing with confidence. The distributor had helped work out the most economical string with the lightest weights and lowest grades capable of handling expected stresses—increased by plans to fracture the well with a 2,500 psi pressure.

Store Manager Joseph Reed came over from Olney, 18 miles away, to be on hand when the casing arrived. Later, Mangum stopped by from Graham, 14 miles away, and Pete Kovack visited the rig before the day was over. He made sure the sequence of events he started had been carried

At Olney, Texas, Store Manager Joseph Reed (in checked shirt) loads a pick-up truck to make a daily service call on rig located in the Young County Regular Pool.

On the drilling floor of rig, Tool Pusher Jesse Johnson, left, and Store Manager Pete Kovack of Wichita Falls, Texas, inspect cementing head used to seal hole and Pittsburgh Steel casing.

out successfully. Reed continued to serve the rig's daily needs from Olney until the well was completed.

That incident involving three store managers is typical of the service rendered by this independent distributor. He's been giving that kind of service day-in and day-out for 40 years.

For 30 years, Pittsburgh Steel Co. has supplied this distributor with oil country goods. During those three decades, oil men who bought drill pipe, casing and tubing from this independent distributor used it with confidence that they were getting the best products, backed up by tops in service.

Mr. Independent supplied the service but the quality of the tubular products came from Pittsburgh Steel Co.'s tube mills.

Starting with the proper chemical analysis, Pittsburgh Steel's blast furnaces and open hearths produce steel tailor-made for the oil country.

Steel for these tubular products has to be good right from the start. Only the best steel can undergo the severe forging operation required to pierce solid tube rounds and convert them into seamless tubes. Only steel with perfect surface and internal soundness can be used.

The hydrostatic test given every single joint made is a final guarantee to oil men that tubular goods made by Pittsburgh Steel Co. will do the job in the field.

That's how steel men and independent distributors make a team that oil men are glad to have back them up when they're working against time to complete a well.

You can't do better than the best. And the best is good steel backed by a distributor who has your interest at heart. That's Mr. Independent who owes his allegiance to only one man—the customer who wants oil country goods when he needs them, where he needs them.

Each of the distributors listed here has that goal. You'll like the way Mr. Independent carries out his job for you. Order your next string from the independent distributor nearest you.

Store Manager Leon Mangum inspects casing in yard of Graham, Texas, outlet for a Pittsburgh Steel independent distributor.

Distributor Home Offices

Bradford Supply Company
Bradford, Pennsylvania

Buckeye Supply Company
Zanesville, Ohio

Cardwell Manufacturing Co.
Wichita, Kansas

C. W. Cotton Supply Company
Tulsa 5, Oklahoma

Franklin Supply Company
Chicago 5, Illinois

Houston Oil Field Material Co.
Houston, Texas

Industrial Supply Company
Wichita Falls, Texas

Iverson Supply Company
Tulsa, Oklahoma

Longhorn Supply Co., Inc.
Houston 14, Texas

Lucey Export Corporation
New York 7, New York

Lucey Products Corporation
Tulsa 19, Oklahoma

McJunkin Corporation
Charleston 22, West Virginia

Midland Supply Company
Wichita 7, Kansas

Mountain Iron & Supply Co.
Wichita 2, Kansas

The Producers Supply & Tool Co.
Fort Worth 2, Texas

Production & Refining Equipment Company
Odessa, Texas

Sandy Supply Company
Wooster, Ohio

Southwest Supply Company
Pittsburgh, Pennsylvania

Superior Iron Works & Supply Co.
Shreveport, Louisiana

Tex-Tube, Inc.
Houston 7, Texas

Western Supply Company
Tulsa 1, Oklahoma

Pittsburgh Steel Company

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DISTRICT SALES OFFICES

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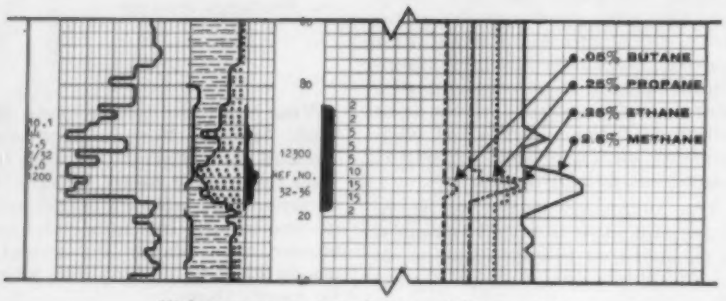
200 BARREL PRODUCING SAND DISCOVERED BY CHRONOFRAC PATENT PENDING

CONTINUING RESEARCH FOR LOWER COST EXPLORATION



High propane content of gas in drilling mud is the distinguishing marker of oil producing zones.

A Mississippi wildcat recently completed in an unexplored area, had forty-five shows. One of them, identified as commercially productive by Hycalog gas CHRONOFRAC, has been confirmed by production tests at nearly 200 barrels per day.

The hole was completed with the barest minimum of coring and testing. Pipe was set to the sand indicated by Hycalog . . . *immediately zone tested* . . . and production commenced.

The gas CHRONOFRAC, developed by HYCALOG, has proven to be a valuable tool in the discovery of oil. The component analysis, not available in conventional well logging services, permits identification of areas where oil as well as gas may be produced.

Let us show you how you can drill far more efficiently with Hycalog CHRONOFRAC well logging. *And let us tell you also about Hycalog's* V-DOOR *diamond drill bits.*

Hycalog, Inc.

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SHREVEPORT, LOUISIANA

BRANCH OFFICES IN PRINCIPAL OIL PRODUCING AREAS

DIAMOND CORING • DIAMOND BITS • WELL LOGGING • CORE ANALYSIS

conference, Jung Hotel, New Orleans.

16-17 Rocky Mountain Oil and Gas Association, midyear meeting, Casper, Wyo.

18-22 Petroleum Equipment Suppliers Association, twenty-fourth annual meeting, Boca Raton Hotel and Club, Boca Raton, Fla.

19-23 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Shamrock-Hilton Hotel, Houston.

22-24 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Herring Hotel, Amarillo, Tex.

22-24 Natural Gasoline Association of America, thirty-eighth annual convention, Baker and Adolphus Hotels, Dallas.

23-24 Sixth annual West Texas oil lifting short course, Texas Technological College, Lubbock, Tex.

24 Society of Petroleum Engineers of AIME, Gulf Coast drilling and production practices meeting, Lafayette, La.

24-25 Society of Economic Paleontologists and Mineralogists, Pacific Coast section, annual spring field trip, Boulder Creek area of Santa Cruz Mountains, California.

26-28 Texas Independent Producers and Royalty Owners Association, membership meeting, Baker Hotel, Dallas.

27-28 Society of Exploration Geophysicists, annual midwestern meeting. Cortez Hotel, El Paso, Tex.

29-30 Western Petroleum Refiners Association, Southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso.

29-30 Pacific Coast Gas Association, operating section, transmission conference, El Mirador Hotel, Palm Springs, Calif.

30-May 1 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

MAY

1 Fourth annual petroleum accounting conference, sponsored by Wichita chapters of the Petroleum Accountants' Society of Kansas. National Association of Accountants, the Kansas Society of Certified Public Accountants, and the University of Wichita, Lassen Hotel and University of Wichita campus, Wichita.

3-6 Liquefied Petroleum Gas Association, twenty-eighth annual meeting and trade show, Conrad Hilton Hotel, Chicago.

4-5 American Society of Mechanical Engineers, maintenance and plant engineering division conference, Edgewater Beach Hotel, Chicago.

4-5 Independent Petroleum Association of America, midyear meeting, Westward Ho Hotel, Phoenix.

4-7 American Geophysical Union, annual meeting, Washington.

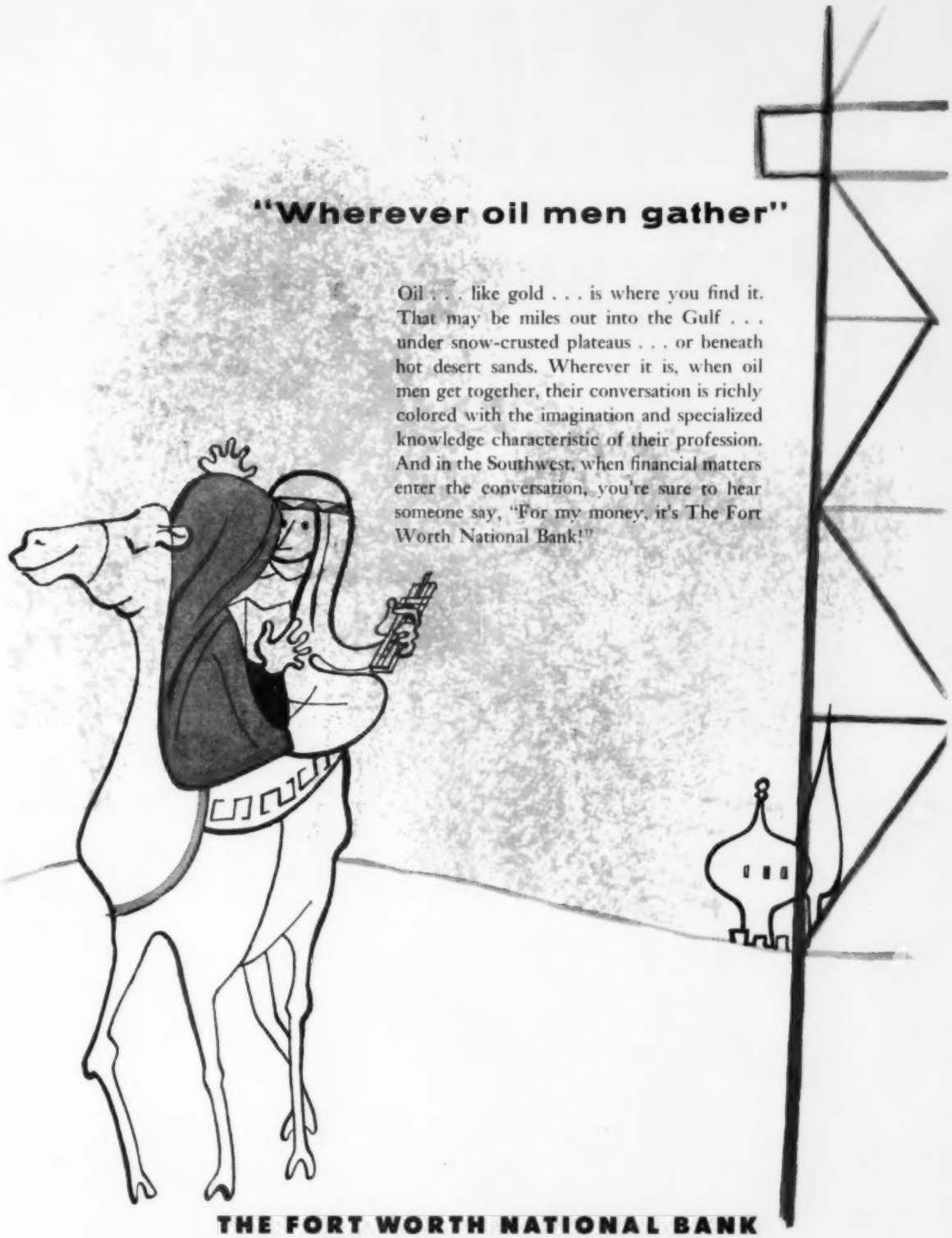
5-7 Purdue University, fourteenth Purdue industrial-waste conference, Purdue Memorial Union Building, Lafayette, Ind.

6-7 Panhandle Producers and Royalty Owners Association, annual meeting, Amarillo, Tex.

6-8 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone, Henning, and Townsend hotels, Casper, Wyo.

"Wherever oil men gather"

Oil . . . like gold . . . is where you find it. That may be miles out into the Gulf . . . under snow-crusted plateaus . . . or beneath hot desert sands. Wherever it is, when oil men get together, their conversation is richly colored with the imagination and specialized knowledge characteristic of their profession. And in the Southwest, when financial matters enter the conversation, you're sure to hear someone say, "For my money, it's The Fort Worth National Bank!"



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Reed tool joints — Super Shrink-Grip — Flash Welded — Counterbore Weld — lead the field. When you buy **Reed tool joints** you get far more for your money — Reed tool joints that will outlast any others.

Reed offers you any combination you need: 18° taper or 90° shoulder: five bores; API regular, full hole, extra hole, internal flush and wide open: INARCLAD hard metal available in two, three or four band applications.

You, the customer, decide what combination of qualities you need. Then, when you call the Reed man, you get the benefit of more than thirty years of experience in tool joint manufacturing, *plus* the combination of qualities you need, *plus* the services of the Reed technical organization, *plus* the design and ruggedness that will make your drilling dollar go much farther.

When you buy tool joints, buy the best . . . buy Reed!

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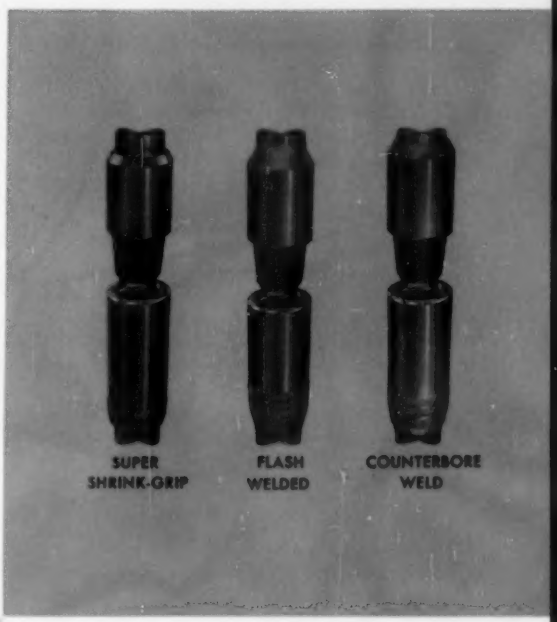
Either 18° tapered or 90° square shoulder tool joints can be supplied.



REED TOOL JOINTS

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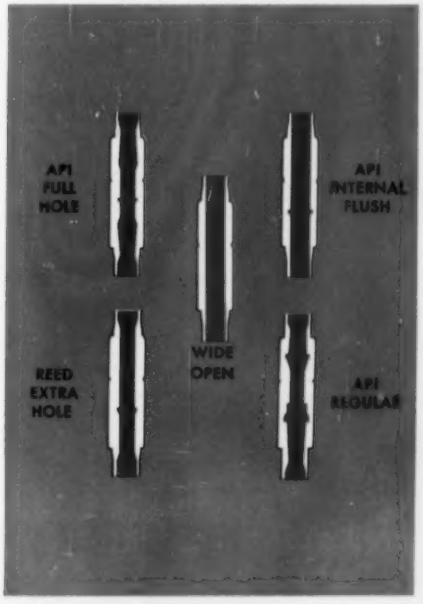
INARCLAD Application No. 418



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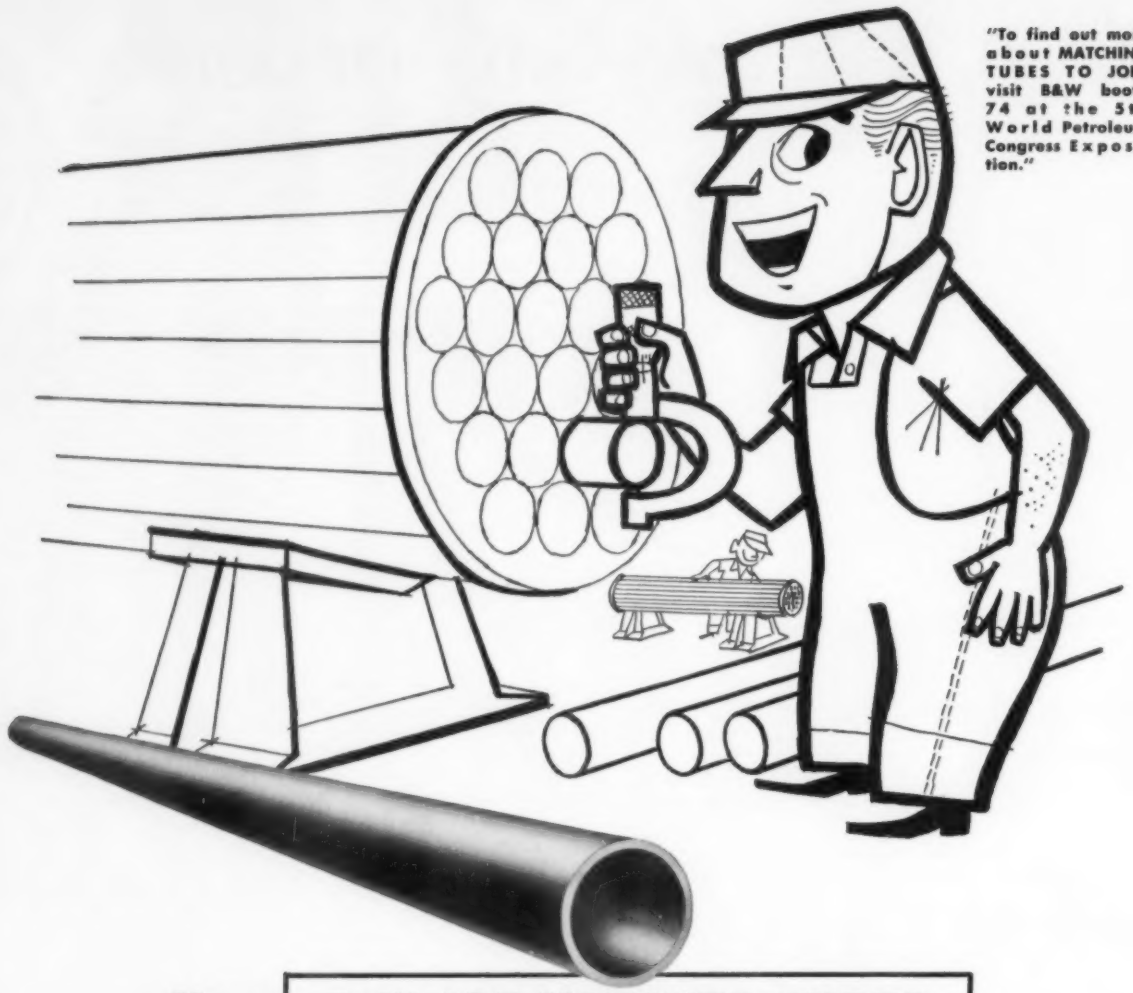

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With B&W Job-Matched Heat-Exchanger Tubes you get:

- . . . tube tolerances and mechanical properties, controlled for ease of fabrication
- . . . a wide range of steels to meet any set of operating conditions
- . . . a complete range of tube sizes, for any type of heat exchanger

This means ease of fabrication to the heat-exchanger manufacturer — long service life to the heat-exchanger user—and ease of tube replacement to those concerned with maintenance.

For complete information about B&W Job-Matched Heat-Exchanger Tubes call the local B&W District Sales Office or write for Bulletin TB-329. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING

The Putt-Putt Boys

THE OIL INDUSTRY is missing a big bet in completely ignoring a large and growing market for petroleum products.

That's the studied conviction of the Journal's art director, C. Dudley Johnston. This stems not from his work in cooking up all the fine charts and drawings we run every week, but from the hobby he rides hard every week end.

Dud is an outboard-motor enthusiast, and he insists there is a real need for a special fuel for outboard motors.

Unless you have been making like Rip Van Winkle for the past several years you should be aware of the fact that throughout the land-locked Great Plains states and every other place where there are natural or man-made bodies of water there is a tremendous boom in outboard motorboating.

There are jillions of outboard owners. Those who don't have permanent docks haul their boats to the lakes on trailers behind their family cars in solid parades every week end. And they pile up a stupendous total of hours of buzzing around the lakes, fishing, towing water skiers, or just cruising.

And do these outboards guzzle the gas! The most popular, medium-sized motors will average about 3 gal. per hour. The trend is toward bigger and bigger motors and most boat owners would like to upgrade their social standing by getting a more powerful job. But the cost of fuel holds them back.

So how about the fuel? Outboards are two-cycle engines, which means that they need a low-octane gasoline mixed with lubricating oil. The bigger marinas carry a mixed fuel which they dispense at dockside pumps for upwards of 50 cents a gallon.

But the average boat owner fills a couple of 5-gal. cans with automobile gasoline at a roadside filling station, mixes in what he figures is the right proportion of oil, and lugs the stuff to the lake in the trunk of his car. This way he gets by for around 30 to 35 cents a gallon.

But, says Dud Johnston, the cost per gallon could be greatly reduced and the number of gallons consumed could be greatly increased if refiners would take the trouble to produce and distribute a fuel especially made for outboard motors.

This would be a low-test gasoline, maybe around 70 octane. It would be scientifically blended with the right amount of lubricating oil. It should contain some kind of additive to keep the oil from separating so that the blend would always be uniform.

And—and this is the biggest gimmick of all—this outboard fuel would be no good for running an automobile and thus it should be exempt from all state and federal taxes on motor fuel.

A low-octane fuel carrying no highway-user taxes ought to be fairly cheap. And, Dud insists, if dealers would stock it at the lakes where people use it, the volume of sales would be so big that distribution costs would be modest also.

Such a development would give a tremendous boost to motorboating. At present a boat owner, unless he is rich enough to patronize the fancy marinas, has to carry his cans to and from the filling station and pay the motor-gasoline price and tax. He spills some of the gasoline while doing his own mixing in his garage—which is both wasteful and hazardous. And when his initial supply is gone he ties up his boat for the week rather than go to all the trouble and expense of loading the cans in his car and driving to a filling station to repeat the process.

Everybody except the oil industry, Dud points out, is getting into the act. The aluminum and fiber-glass people are making boats lighter, cheaper, and maintenance-free. Motors are becoming bigger, more dependable, and loaded with labor-saving gadgets. The makers of fishing tackle, picnic supplies, seat covers, radios, and accessories are cashing in on the boating craze in a big way.

But the oil industry, for all its bragging about being progressive, has ignored the putt-putt boys completely.

Our man Johnston is sick and tired of lugging those cans of motor gasoline and mixing his own fuel, and he figures about 17 million other Americans are in the same boat. He's launching a one-man crusade to get something done about it.

—Henry D. Ralph

there's something new in Packers!

Where there is a need... Baker shows the way. Recognizing a need for an economical, retrievable and yet dependable packer for water flooding and other pressuring applications in shallow or low fluid wells, Baker engineers have come up with the new Model "A" Tension Packer.

Compact design makes the big difference in this new packer. Imagine the ease of shipping, storing and handling a packer less than 30" long. Its size is deceptive, for it contains many field-tested features of Baker retrievable squeeze tools.

For example, there's a "full bore" to permit the passage of instruments through and below the packer; a proven packing element that assures positive pack-off; and *rocker-type slip units* that eliminate cumbersome drag springs, slip tie-links, and guide grooves. For simplicity of operation, there's the reliable J-Slot setting and release mechanism.

Get to know the Model "A" better. There *is* something new in packers, and your Baker man has all the facts. Call him for information on how the Baker Model "A" Tension Packer can solve *your* hook-wall packer needs, or write for Bulletin No. 334.

PRODUCT NO. 739-A

BAKER
OIL TOOLS, INC.
HOUSTON • LOS ANGELES • NEW YORK

MODEL "A"
TENSION PACKER

The mechanics may be imperfect, but the imports policy is set

WE share with President Eisenhower the deep regret that a mandatory program has become necessary to restrict oil imports.

But the new plan has two big virtues: It establishes a basic policy, and its mechanics are open to improvement as experience is gained.

It is important to realize that this is neither a permanent, inflexible program nor a half-hearted, temporizing gesture. It is a sincere grappling with the problem of a world-wide surplus of oil.

Out of the continuing studies and negotiations that are called for, something better than this plan may be evolved in time. But something worse could be precipitated quickly if disgruntled foreign or domestic interests resort to courts, Congress, or diplomatic maneuvers before giving this a fair trial.

THE VOLUME OF IMPORTS permitted is higher than domestic producers wanted but lower than was generally expected. It gives foreign oil as a whole a reasonable, if not generous, share of our market.

The exact quantity of imports is less important than the policy underlying the restriction. This is that national security requires that the U. S. industry be insulated from a vicious circle of world-wide competitive price cutting.

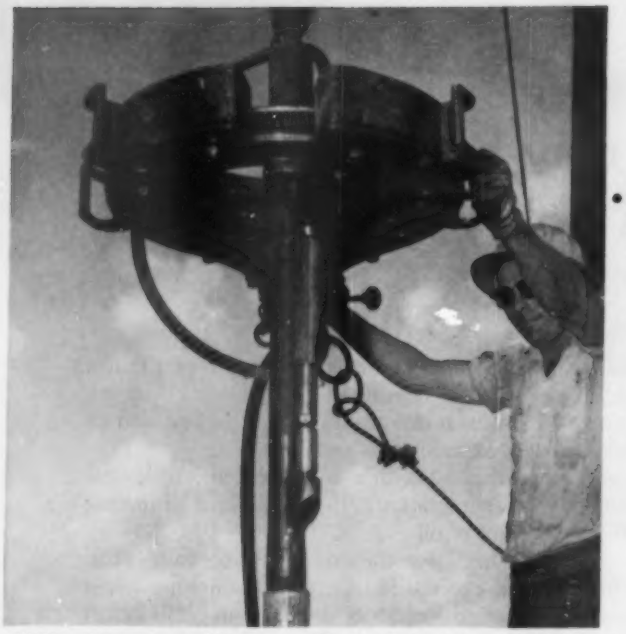
Both individual importers and the governments of exporting nations ought to prefer a smaller share of a healthy, prorated market than a larger share of a demoralized, cut-throat market. This could lead to proration of production in additional domestic and foreign areas.

No big effect on activity in the domestic producing industry should be expected immediately. This spring won't see much increase in allowables, stiffened crude prices, or spurt in the drilling rate directly attributable to the imports restriction. Its benefits will be less direct and longer ranged, and will grow out of the confidence that the industry will not be undermined by increasing quantities of low-cost imports.

Domestic producers can live with imports at the level set—provided the products refined from imported crude are not sold at such low prices as to break the market for all. Apparently the allocation formula hopes to neutralize the price advantage by making imports only a minor portion of any one refiner's total supply.

A HUNDRED FLAWS could be picked in the program. It is unfortunate that its architects were unable to devise a perfect plan that suited everybody. It is most unfortunate that no way was found to meet defense objectives by giving preference to nearby sources in this hemisphere.

Critics can be assured that every possible angle was explored diligently and in good faith, and that in the considered judgment of responsible officials this is the most practicable at the moment.



All-Monel Camco gas lift valve, with mandrel, made up in tubing string. Well is in Southwest Texas, where corrosion problems are common.

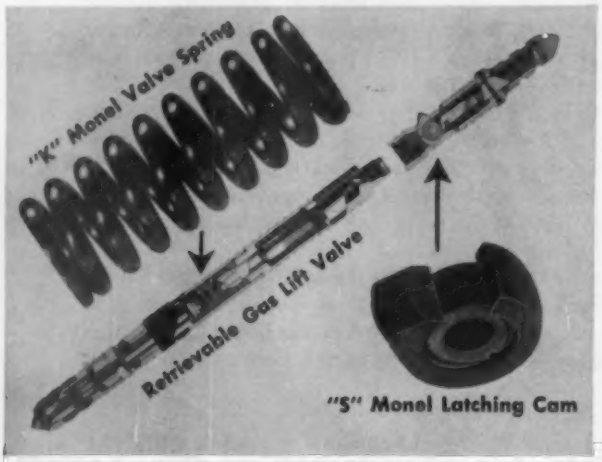
...Camco tailors them with Monel alloys for local sour well conditions

Gas lift payout often depends on how long the downhole valves and tools stand up to corrosive well fluids and abrasion.

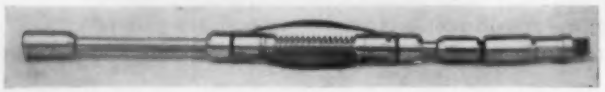
Camco designers make sure their gas lift valves will stand up . . . they use 3 Monel* nickel-copper alloys in critical parts to offset local sour well conditions.

In Wyoming, Camco found that sour wells were chewing up ordinary latching tool cams in 6 months or so. They replaced them with cams of cast "S" Monel* hard-grade nickel-copper alloy which resists corrosion, galling and seizing . . . and works for years. (See middle photo.)

Lifts life of gas lift valves and tools



"S" Monel alloy latching cam has high hardness, corrosion resistance, stands up to years of pulls, in acid and sand. "K" Monel alloy valve spring has high elasticity, corrosion resistance.



Retrieving tool uses Monel alloy spring, serves well in hydrogen sulphide. For extreme corrosive conditions, rest of tool is made of "K" Monel alloy.

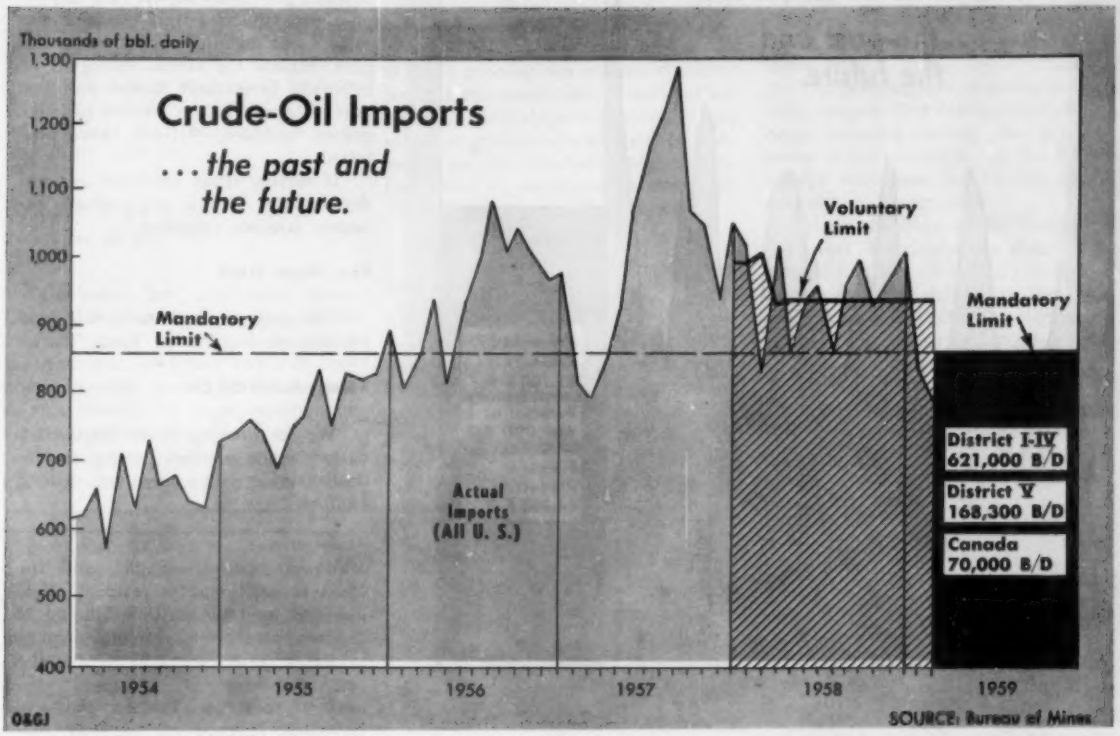
In Canada, certain wells produce quantities of hydrogen sulphide—so corrosive that steel springs in retrieving tools have crumbled in the fingers after 3 hours in the well. Most other metals do little better. Camco depends on "K" Monel* springs which go hundreds of round trips without visible corrosion damage. Usually, they last as long as the rest of the tool. (See bottom photo.)

In Mexico, Texas and Canada, some fields produce acidic crudes loaded with H_2S, brines, carbonates; often in combination. For these tough conditions, Camco makes gas lift valves entirely of Monel alloys. (See top photo) Camco men state emphatically that other metals just don't do the job.

For further information on Camco valves, contact Camco, Inc., Houston, Texas. And for proven ways to use Inco alloys in boosting tool life, write Inco for "Metals to Make Petroleum Production Equipment Produce More."

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street INCO New York 5, N. Y.
*Registered trademark

INCO NICKEL ALLOYS



THE MANDATORY LIMIT for crude-oil imports shown on this chart is based on the assumption that unfinished products will reach 10% of the combined crude oil-unfinished products allocation. The combined quota in District 1-4 is 690,000 bbl. daily and in District 5 is 187,000 bbl.

What Mandatory Controls Mean

● The Government's new program will slap a tight lid on crude and most products. Some leeway is provided and some special treatment for Canadian crude, but in general it will cut sharply into current import patterns.

MANDATORY import controls ordered last week by President Eisenhower will reduce total incoming shipments of crude oil and products about 15% below their 1958 levels.

The long-anticipated program, unprecedented in oil-government relations, covers crude oil and all principal petroleum products. It will cut over-all imports by about 270,000 bbl. per day below the 1958 average.

Greatest impact will be felt by importers of finished products, other than residual fuel oil. Imports in this category will be held about 80,000 bbl. daily below their 1958 averages and 240,000 bbl. below the recent peak.

Some individual importers will be hit much harder than the nation-wide averages would indicate. The program makes room for more than 100 prospective importers. In contrast, only about 40 companies had import quotas under the voluntary program which ended last week.

Lower ceiling . . . Effect of the new program will be to place a ceiling on total petroleum imports at about 1,415,000 bbl. per day.

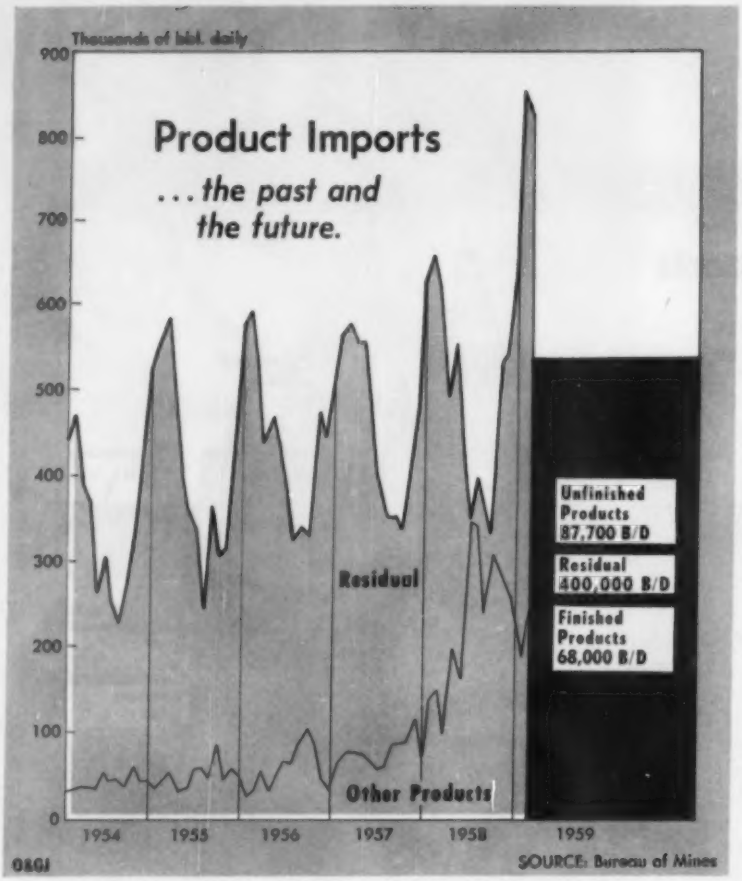
The average last year was about 1,685,000 bbl.

Crude oil and unfinished products will account for approximately 947,000 bbl. daily of this total. Not more than 10% is allotted to unfinished products.

Under the voluntary program, crude quotas totaled 934,100 bbl. daily. Efforts also were made to limit imports of unfinished oils to 179,500 bbl. for total daily voluntary allocations of 1,113,600 bbl.

In Districts 1-4, including all states east of the Rockies, crude and unfinished products may enter at the rate of 820,000 bbl. per day. This includes a maximum of approximately 60,000 bbl. in finished products and 69,000 bbl. of unfinished products. The crude allocation will be about 621,000 bbl. daily.

Canadian oil will be given an ad-



SOME PRODUCTS imported in the past may be excluded under the mandatory program. However, they are plotted on the chart above. Residual oils used to make asphalt would fall in this classification. In plotting the mandatory limit for product imports unfinished products were figured at their maximum.

ditional quota for shipment to northern refineries which do not have ample supplies of domestic crude. This total is estimated at 70,000 bbl. daily.

Total allocations for District 5 are approximately 195,000 bbl. per day. Included in this district are Arizona, Nevada, California, Oregon, Washington, Alaska, and Hawaii.

Approximately 7,000-8,000 bbl. of the West Coast allocations will be for finished products. This will leave an estimated 187,000 bbl. for crude and unfinished products.

Under the 10% formula, the District 5 allocation of 187,000 bbl. for crude and unfinished products would break down with the crude maximum being 168,300 bbl. daily if a maximum of 18,700 bbl. of unfinished products is imported.

Quotas coming . . . Residual oil used as fuel will be allowed to come in at the rate of about 400,000 bbl. per day, with quotas limited to the actual 1957 import level.

Very little of the residual will enter on the West Coast, where such imports are limited primarily to military use.

The President's proclamation leaves details of the new quota system to be worked out by Interior Sec. Fred A. Seaton. Allocations for crude and unfinished products, including residual for reprocessing, will be based on refinery runs during a base period in 1958.

As recommended by the cabinet fuels committee, initial quotas for an individual refiner will not be cut more than 20% below the company's allocation under the voluntary program.

Here are some of the major provisions of the new program:

. . . Controls on crude oil and unfinished products went into effect March 11, the day after the voluntary program expired. Finished products will come under the new program April 1.

. . . In Districts 1-4, imports of crude oil, unfinished oils, and finished products except residual oil to be used as fuel shall be limited to "approximately 9%" of total demand in the area as estimated by the Bureau of Mines.

. . . Imports of finished products, including residual oil used as fuel, are not to exceed the 1957 rate, either in Districts 1-4 or in District 5.

. . . In District 5, imports of crude oil, unfinished oils, and finished products will be allowed to fill the gap between domestic supply and total demand.

. . . Unfinished oils will be allowed up to 10% of the combined quota for crude and unfinished oils, both in Districts 1-4 and in District 5.

. . . Additional crude-oil imports will be permitted to meet the needs of refiners which can't obtain sufficient domestic crude oil "by ordinary and conventional means, such as by barges, pipelines, or tankers." The same provision applies to pipeline companies using crude oil directly as fuel.

. . . All petroleum imports into Puerto Rico shall be limited to approximately the level of a base period in 1958. The formula and later adjustments to meet changing conditions are left up to the Interior Secretary.

. . . Residual imports to be used as fuel are to be kept under review by the secretary, and he may make monthly adjustments as he sees fit.

. . . Federal agencies are to reduce

Reaction to the

Atlantic Refining Co.

"Although we have not yet received detailed provisions of the new import plan, we understand it contains the same basic inequities of the Carson plan, mainly the virtual disregard of historical investment factors and import patterns which a number of companies, including Atlantic, have protested.

"If further study confirms our understanding, Atlantic will probably examine possible remedies."

Rep. Frank Ikard

"The program ought to have a good psychological effect in Texas."

Socony Mobil Oil Co.

"We see nothing in the import situation which justifies putting the industry under such involved federal controls."

mandatory plan is varied

Charles W. Alcorn
President, Texas Mid-Continent Oil and Gas Association

"I think they have done the best they could. The plan is as good as the industry could expect.

"It would have been better to have it voluntary, but it appeared that was impossible. I hope this doesn't lead to any more controls."

George F. Getty II
Tidewater Oil Co.

"Tidewater has constantly maintained that there is negligible risk to national security involved in giving the American consumer access to economic benefits resulting from the use in this country of large amounts of oil from overseas.

"The domestic oil producers who have pressed so long to secure the protection of oil import restrictions now find themselves faced with the hard reality that price controls may be the next step in the regulation of oil which has always been an aggressive self-sufficient industry.

"The federal Government by its action yesterday has undone much of its previous constructive work in cementing friendships with some of our allied oil-producing countries. In summary, we can conclude only that the institution of mandatory controls on oil imports was a serious mistake."

L. F. McCollum
Continental Oil Co.

"However, the company regrets the imposition upon the American petroleum industry of a federal mandatory system of import controls. . . . It is to be hoped that this action will work in the interest of national defense and will not lead to further governmental regulation of the domestic petroleum industry."

Venezuelan Embassy

"The Embassy of Venezuela had been advised in advance . . . of the essentials of the mandatory oil program. . . . In the course of conversations . . . Venezuela's views have been made clear.

"The Embassy of Venezuela notes with concern that residual fuel oil has been included among the products under import controls, as the burden of the limitation would fall almost entirely on Venezuela.

"Along the lines of the President's statement, Venezuela has always considered that her oil industry is vital to the security and defense of the Western Hemisphere and of the free world; that for the primary purpose of such security and defense the oil industry of the Western Hemisphere should be considered as one and indivisible; and that from the standpoint of individual countries, both the U. S. and Venezuela must complement each other."

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their imports to conform with general regulations affecting private companies.

Under the presidential proclamation, government purchases of foreign oil will be held to about 35,000 bbl. a day. Recently, such purchases by the military have been running 60,000 bbl. or more per day.

This figure does not include withdrawals from bonded storage for bunkering vessels or aircraft in foreign trade. These withdrawals total about 20,000 bbl. daily. The Tariff Act of 1930 exempted the excise tax on bonded fuel used to bunker vessels in foreign trade.

Police powers . . . Import licenses, to be issued by the Secretary of the Interior, will be required for individuals and private companies bringing oil into this country.

The customs bureau, which will serve as imports watchdog, will continue to admit oil without license until interior regulations are issued, however.

Agencies of the U.S. Government will not be required to have import licenses, but their imports will be subject to allocations assigned by Sec. Seaton.

Quotas for crude oil and unfinished products will be assigned to domestic refiners on the basis of refinery input. In general, these imports must be processed at the licensee's refinery, although under certain conditions it may be exchanged for domestic supplies.

Persons or corporations who imported finished products in 1957 will be entitled to quotas for the same volumes under the new controls.

The Secretary of the Interior has the power to revoke or suspend the license of any importer who violates the terms of the presidential order. Such action also can be taken "on grounds relating to the national security . . ."

An appeal board will be set up for review of quotas. It will include one official each from the Interior, Defense, and Commerce departments.

Under certain circumstances, the board may modify quotas or grant them to persons who ordinarily would not qualify. Such extra allocations, though, are to come within the overall limits set by the President.

The price angle . . . The new program carries with it a hint of possible price controls in the future.

The director of the office of civil and defense mobilization is charged with the responsibility of keeing a "constant surveillance" of imports. He is to report to the President if he thinks further action by the chief executive is needed to keep imports from threatening the national security.

If the price of crude or products is increased, the OCDM director is to determine "whether such increase or increases are necessary to accomplish the national security objectives" of the foreign trade law.

Presidential Press Sec. James C. Hagerty told newsmen that Eisenhower himself raised the question about the program's effect on prices.

Capt. Matthew V. Carsons, Jr., who will continue as imports administra-

The New Import Quotas

BASED on figures released by President Eisenhower last week, here is how imports will break down under the mandatory imports program.

Crude oil and unfinished products*	
Districts 1-4	690,000 B/D
District 5	187,000 B/D
Residual	400,000 B/D
Finished products	
Districts 1-4	60,000 B/D
District 5	8,000 B/D
Canada	70,000 B/D
GRAND TOTAL	**1,415,000 B/D**

*Imports of unfinished products are limited to a maximum of 10% of the total quota for both crude and unfinished products. Assuming maximum imports of unfinished products, the quota for Districts 1-4 would break down into 621,000 bbl. of crude and 69,000 bbl. of unfinished products daily. In District 5 the crude-oil figure would be 168,300 bbl. and the unfinished products maximum 18,700 bbl. daily.

tor, said he doubted that the new controls would have any effect on prices, however. He noted that there recently had been a round of wage increases in the petroleum industry and that they probably will be felt in future prices.

Ike regretful . . . The President said that the voluntary import program had demonstrated "the willingness of the great majority of the industry to cooperate with the Government in restricting imports to a level that does not threaten to impair security."

"I commend them," he added, "and to me it is indeed a cause for regret that the actions of some in refusing to comply with the request of the Government require me to make our present voluntary system mandatory."

He said informal conversations have begun with Canada and Venezuela "looking toward a coordinated approach to the problem of oil . . ." The President expressed the hope that agreement can be reached which will take into account the interests of all oil-producing states.

Congressional reaction . . . On Capitol Hill, reaction to the presidential order was generally favorable among the producing-state delegations. Some congressmen assumed a wait-and-see attitude while others, notably from New England, were disappointed because the new program restricts residual imports.

Despite some anticipated opposition in Congress and a probable early test in the courts, the new program was designed to remain in effect indefinitely.

After receiving the cabinet committee's latest report, President Eisenhower discharged it of any further responsibilities.

The program has a degree of flexibility to allow for future changes in the imports picture.

The first allocations will be for the period ending June 30. After that, quotas will be for 6-month periods.

Individual quotas may be adjusted within the allocation periods by the Secretary of the Interior or the appeal board.

In this respect, the program is similar to that proposed by Sen. Joseph C. O'Mahoney (D-Wyo.) and others in bills now pending before Congress.

But there is one clear distinction between the new Eisenhower program and the O'Mahoney proposal. While O'Mahoney would allow the total imports level to fluctuate at the discretion of the Secretary of the Interior, Eisenhower has set the ceiling below which fluctuations may occur.

watching WASHINGTON

Joe Reilly

• Treasury bill may speed depletion vote . . .

THE DEPLETION ALLOWANCE MAY BE DESTINED for a fight this year in both houses of Congress.

An attack on the 27½% rate had been expected in the Senate all along. Sen. William Proxmire (D-Wis.) enjoyed the limelight last year when, as a newcomer to the Senate, he introduced an amendment which would have cut the rate to 15% for big producers. He is awaiting the opportune time to try again this year.

Depletion suddenly became a live issue in the House as a result of legislation sought by Sec. of the Treasury Robert B. Anderson. The bill which he recently sent to Congress would prevent oil operators from applying depletion to finished products. On the face of it, his proposal would have little effect on depletion as it has been traditionally interpreted. It would leave the rate unchanged for crude oil and gas at the well.

Chairman Wilbur Mills (D-Ark.) of the House ways and means committee had hoped to avoid a showdown on depletion this year. Now, when hearings are held on Anderson's proposal, committee members and witnesses may take the opportunity to attack the whole principle of depletion.

Anderson's move was prompted by a district-court ruling which upheld depletion when applied to products from a cycling plant. The case is now on appeal before the U.S. circuit court at New Orleans. The issue may be settled there before Congress goes home.

There has been some speculation that Anderson may have brought up the issue at the suggestion of Congressional leaders who are ready for a showdown on the whole depletion question. But that seems unlikely.

Depletion backers are relatively confident that it could withstand an attack this session. But the vote is likely to be much closer than in the past. Even a close vote would reduce the chances for survival in future sessions.

• Pushing gas bill would be 'lost motion' . . .

THERE ARE MORE TROUBLES on the horizon for natural-gas producers.

Rep. Oren Harris (D-Ark.) has abandoned, at least temporarily, his long fight to reduce federal controls on independent producers.

As chairman of the House interstate and foreign commerce committee, Harris has made it clear he plans no hearings on the bill this year unless advance endorsement is given by President Eisenhower. The President, who had urged such legislation in the past, has carefully avoided the subject this year.

Besides the administration's coolness, the bill this year apparently faces "outright opposition from one segment" of the industry. Partly because of squabbling within the industry, Harris has decided that his committee has "plenty of other work to do" without going through the "lost motion" on a bill that already appears doomed.

Much of the opposition stems from the so-called "coal amendment," which was written in to prevent "dump" sales of gas from displacing other fuels. Harris has said that most of the interested transmission companies "reluctantly agreed to go along" with the amendment, however.

It has been almost 5 years since the Supreme Court's "Phillips decision," which subjected independent producers to federal price controls. During that period, gas has been unable to compete on an equal basis with other fuels.

Yet, in the view of one federal official, gas already may be pricing itself out of a market. Vice Chairman William R. Connole of the Federal Power Commission warns that liquefied methane imported by tanker soon may start crowding domestic gas out of some of the big coastal markets.

Canadian Petroleum Reserves Rise

• Discoveries of new fields play minor role in increasing nation's available hydrocarbons. Developments in proven areas responsible for most gains.

RESERVES of petroleum and natural gas hit an all-time high in Canada in 1958.

The annual report of the Reserves Committee of the Canadian Petroleum Association gave this accounting on reserves at the end of the year:

... **Crude oil,** 3.1 billion barrels.

... **Natural-gas liquids,** 484 million barrels.

... **Natural gas,** 23.2 trillion cubic feet.

These totals represent gains of 291 million barrels for crude oil, 89.5 million barrels for natural-gas liquids, and 2.5 trillion cubic feet for natural gas.

The CPA committee explains that the reserves represent only proved recoverable petroleum and natural gas in the ground. The location and extent of the reserves have been established by the oil industry's continuous drilling program. They do not include estimates of petroleum or natural gas which may be discovered by future activities.

How it's done . . . One ominous note in the tabulation of reserves is the role played by new discoveries.

Drilling turned up much less petroleum and natural gas than Canada produced. If extensions of known pools and revisions of previous reserve estimates had not provided large volumes, Canadian production would have outstripped new hydrocarbons, and reserves would have dropped.

Discoveries during the year added 9,311,000 bbl. of crude, 35,395,000 bbl. of natural-gas liquids, and 469.8 billion cubic feet of gas.

Extensions and revisions, however, added 448,100,000 bbl. of crude, 59,000,000 bbl. of natural-gas liquids, and 2.4 trillion cubic feet of gas.

Who has it . . . Alberta maintained its rank as Canada's No. 1 petroleum storehouse.

The province ended the year with crude reserves of 2.5 billion barrels, natural-gas liquid reserves of 422 million barrels, and 20 trillion cubic feet of natural gas.

Saskatchewan was the second ranking oil province while British Columbia ranked second in natural gas and gas liquids.

Canada's Proven Reserves Hit Record Peak in 1958

	Reserves, Dec. 31, '57	Extensions and Revisions	Discoveries*	Production 1958	Reserves, Dec. 31, '58	Changes during 1958
CRUDE OIL (Thousands of barrels)						
Northwest Territories	52,858	17	.....	466	52,409	— 449
British Columbia	2,093	5,523	1,850	508	8,958	+ 6,865
Alberta	2,360,933	319,803	5,425	113,551	2,572,610	+ 211,677
Saskatchewan	420,457	120,279	1,493	44,857	497,372	+ 76,915
Manitoba	34,258	—927	40	5,871	27,500	— 6,758
Ontario	3,763	3,489	503	777	6,978	+ 3,215
New Brunswick	92	.....	.....	15	77	— 15
Total	2,874,454	448,184	9,311	166,045	3,165,904	+ 291,450
NATURAL-GAS LIQUIDS (Thousands of barrels)						
British Columbia	23,509	4,270	1,252	1,455	27,576	+ 4,067
Alberta	370,654	55,123	200	3,397	422,580	+ 51,926
Saskatchewan	497	—350	33,943	53	34,037	+ 33,540
Total	394,660	59,043	35,395	4,905	484,193	+ 89,533
Total Liquid Hydrocarbons	**3,269,114**	**507,227**	**44,706**	**170,950**	**3,650,097**	**+ 380,983**
NATURAL GAS (Millions of cubic feet)						
Northwest Territories	29,705	59	.....	337	29,427	— 278
British Columbia	1,803,075	—166,058	113,120	62,511	1,687,626	— 115,449
Alberta	17,702,885	2,418,986	356,261	257,446	†20,222,824	+2,519,939
Saskatchewan	1,011,118	198,209	8	44,332	1,165,003	+ 153,885
Manitoba	2,993	—136	3	515	2,345	— 648
Ontario	190,287	11,346	500	15,350	186,783	— 4,504
Quebec	983	—900	.....	.....	83	— 900
New Brunswick	1,085	.....	.....	124	961	— 124
Total	**20,742,131**	**2,461,506**	**469,892**	**380,615**	**23,295,052**	**+2,551,921**

*Only a limited area is assigned to each new discovery even though the committee may believe that eventually a much larger area will produce, because in this report the committee is concerned only with actually proved reserves. Hence, figures in this column may be considered minimum figures. †Includes an increase of 2,138 million cubic feet in underground storage.

Price-Cost Pinch Hurts

. . . California oil operators in wake of Union's slash. Cuts, however, hailed by state's independent refiners.

CALIFORNIA producers, hard hit by earlier price cuts and marketing problems, will be forced to take in their belts still another notch if Union Oil Co.'s new postings are adopted by other purchasers.

Their situation is this: Drilling and production costs are up. But operators are receiving far less for low-gravity crudes than they did 10 years ago. The lower gravities predominate in California production.

The full price story is reflected by what's happened to three typical California fields: Rio Bravo (high gravity), Kern River (low gravities), and Signal Hill (all gravities).

Kern River 13-13.9°-gravity crude in 1948 brought $2.07 per barrel while Rio Bravo field (40°-gravity plus) crude was worth $2.64. That's a price spread of only $0.57. The gap between the same crudes today would be $1.32 per barrel if Union's new postings stick ($1.60 for Kern River and $2.92 for Rio Bravo).

Thus far, no other companies have followed Union's price cut. The major purchasers indicated last week all are still studying the question. Speculation is that if others follow, they will not cut as deeply as Union did.

Kern River outlook . . . Production from Kern River field currently runs 14,800 bbl. daily of crude averaging 13-13.9° gravity.

At 1948 postings, this production was worth $30,636. Today the volume will gross only $23,680. But that's not the entire picture. If this $23,680 gross were converted to 1948 dollars, the gross would be the equivalent of about $19,200.

While Kern River crudes have fluctuated in price from a low of $1.02 in 1949 to a high of $2.52 in early 1957, production labor costs have steadily climbed by 85 cents an hour, and drilling costs have gone up $3.75 per foot.

Signal Hill picture . . . Until this month's cut by Union Oil, 14°-gravity crudes and below at Signal Hill had been cut 81 cents per barrel in less than a year.

The light crudes at Signal Hill—33° gravity and above—had experienced a cut of only about 11 cents a barrel.

Union's postings narrowed the gap considerably by cutting light crudes as much as 60 cents a barrel while leaving the heavy crudes untouched.

At one point, there was a $1.74 per barrel difference between the lowest and highest gravity crudes at Signal Hill. Union's postings have only a $1.21 gap. Others, including Standard Oil Co. of California, still have a posted difference of $1.70 per barrel in the gravity extremes.

It's interesting to note that the middle-grade crudes have been changed the least. Cuts in the 20-20.9°-gravity range average only about 40 cents at Signal Hill.

The cause—The reasons for unpopularity of heavy crudes are not hard to pinpoint.

In essence, two things have occurred to upset traditional place of these crudes in California refining.

. . . Natural-gas imports have soared to almost 2 billion cubic feet daily since 1947. This tremendous increase in gas usage has largely been at the expense of fuel oils—a main product of California's heavy crudes.

. . . Foreign light-gravity imports have jumped from virtually nothing in 1947 to about 215,000 bbl. daily last month.

These lighter crudes are much preferred by refiners because they yield a greater percentage of gasoline and less residuals. That fits the refiners' marketing picture where demand for gasoline keeps growing and demand for residuals is on the decline. Result is that imports have hurt the low-gravity crudes which give a high residual yield.

The deteriorating price structure of heavy crudes has not only created a widening gap between light and heavy crudes but also has driven a wedge between California's independent refiners and independent producers.

When Union's posting's were announced 2 weeks ago, the Oil Producers Agency of California, composed of independent producers, fired off a barrage of protesting telegrams to the President, cabinet officials, and major California purchasers.

On the other hand, the Independent Refiners Association of California hailed the new postings as "a glimmer of hope for the California independent refiners . . . "

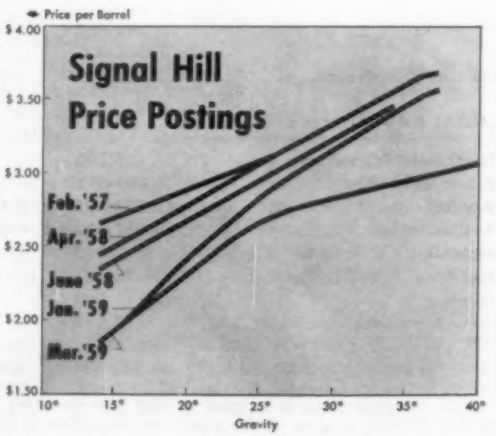
What Union's Cut Would Do to Signal Hill Prices

IN LAST 2 YEARS, price cuts in California have hit first the heavy-gravity crudes and then the lighter ones.

This situation is illustrated clearly in the bends of the lines in accompanying chart.

Note that the price postings in June 1958 for the different gravities of Signal Hill crude had a straight-line relationship as the price rose with gravity. Cuts in January 1959 bore heavily on the lower gravities, much less on the lighter crudes.

Just the reverse was true of Union Oil Co.'s new postings this month. The result is a price-gravity curve now that is bent at both ends. This gives rise to the belief that even if other California purchasers join Union's cuts they will not be as severe.



"The Union Oil Co.'s new crude postings finally reflect a workable relationship between present product prices in this area and the cost of crude oil. We sincerely hope that the other major oil companies will follow the pattern set by Union, and we strongly recommend that these companies consider the economic crisis that has been facing the small California refiner during the past year," the Independent Refiners Association statement read.

Oil Wins a Round

as Texas legislators halt planned highway leasing.

THE TEXAS petroleum industry won at least a temporary victory last week in its running battle with the Texas Highway Department over leasing of highway rights-of-way for oil operations.

Pressure exerted by the Texas Legislature has forced the recently created Texas Board for Lease of Highway Department Lands (OGJ, March 2, p. 61) to cancel a planned first offering of rights-of-way at the upcoming April 7 auction of oil and gas leases on state-owned lands.

The Texas house passed without discussion a resolution submitted by six of its members which asked the board to refrain from leasing rights-of-way until the legislature sets state policy.

The resolution sets up a committee to investigate the highway department's action in preparing to lease rights-of-way and the legalities and equities involved. It will report back to the legislature by March 23.

The rights-of-way at issue were secured by the department prior to 1943 before that body reverted to a policy of acquiring only surface rights. They total about 211,000 acres, according to the department, of which about 26,000 acres are in oil and gas-producing areas.

Canadian Oil Tax Proposed

THE SASKATCHEWAN government is studying a bill which would tax gross oil production 1%.

Such a levy would amount to an estimated $1,000,000 per year. Production in Saskatchewan last year was about 45,000,000 bbl.

The proposal was attacked by the Canadian Petroleum Association which said the tax would have "a disastrous effect on the oil industry." CPA asked the premier and cabinet to withdraw the bill.

Reds Can Veto Shale Blast

. . . AEC official indicates. Postponement of a year is planned to avoid stirring up international complications.

THE GENEVA conference apparently will decide the fate of the controversial plan to explode test atomic bombs in Colorado's huge oil shale deposits.

An indication of this comes from Dr. Willard F. Libbey, a member of the Atomic Energy Commission in Washington. He says the Colorado experiment, along with other phases of America's atomic project Plowshare, will not go ahead until the United States is certain that peaceful underground blasts can be set off without shattering the Russian-American truce in weapons testing.

The experiments include explosions to test the feasibility of freeing oil and gas from shale deposits in the Piceance Creek basin of northwestern Colorado and nuclear blasts in salt deposits near Carlsbad, N. M., to test the possibilities of making atomic power and isotopes. A series of three shots of conventional explosives in the salt deposits was completed last month.

Delay seen . . . John McCone, chairman of the AEC, indicates the explosions probably will be postponed for a year so as not to stir up international complications.

Libbey said the AEC believes an atomic shot equivalent to 300,000 tons of TNT would crush or break shale containing 20 to 40 million barrels of oil in the Green River shale deposits of Colorado, Wyoming, and Utah.

The U. S. Bureau of Mines is now asking 71 oil and chemical companies and individuals to participate in the atomic oil-shale project (OGJ, Mar. 2, p. 72).

There's a controversy, however, over whether the proposed atomic blast would endanger people in Colorado and neighboring states. Morgan G. Huntington, head of an atomic development company at Salt Lake City, and U. S. Rep. Daniel J. Flood of Pennsylvania, believe it would. The AEC and U. S. Sen. Gordon Allott of Colorado say it wouldn't.

Navy Holds Up Its Legal Fire

. . . in California's Long Beach subsidence suit. Operators show progress in halting land sinking by repressuring.

STUDIES showing subsidence has either stopped or slowed down in several areas last week prompted the Government to delay its suit against California's Wilmington field producers.

William P. Gray, special assistant to the U. S. Attorney General, said investigation by his office indicated operators were "making reasonable progress" in their repressuring programs.

Gray's petition to the federal court, requesting the suit be taken off the calendar, was granted. Gray warned, however, that the suit will be reopened if the voluntary program slows down.

The Government had demanded the field be shut in unless repressuring was undertaken on a crash basis.

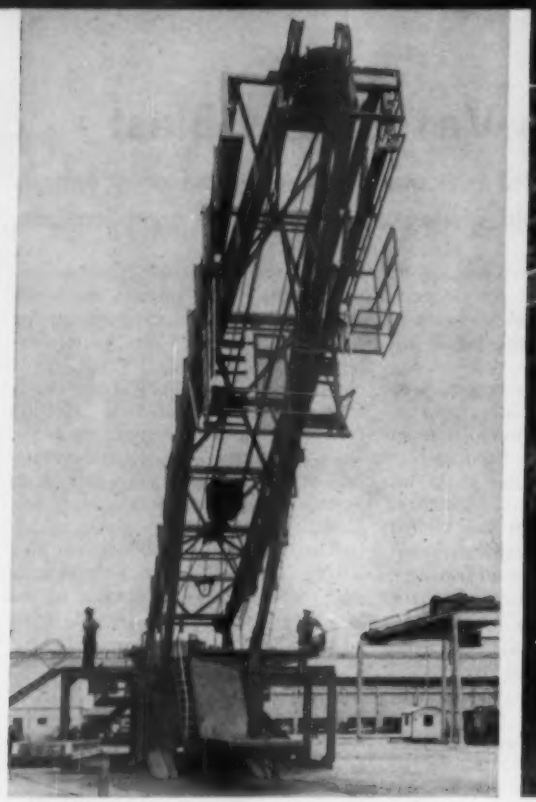
Charles L. Vickers, Long Beach port manager, reported flooding had stopped the land sinking entirely in a 600-acre area and slowed it substantially on 900 acres elsewhere.

Areas where subsidence had halted included a portion of Pier A, the outer end of Pier E, and the eastern end of the navy mole in the west basin. Sinking had slowed down on the rest of Pier 3, most of the rest of Pier A, and at the southeastern end of the Long Beach naval shipyard.

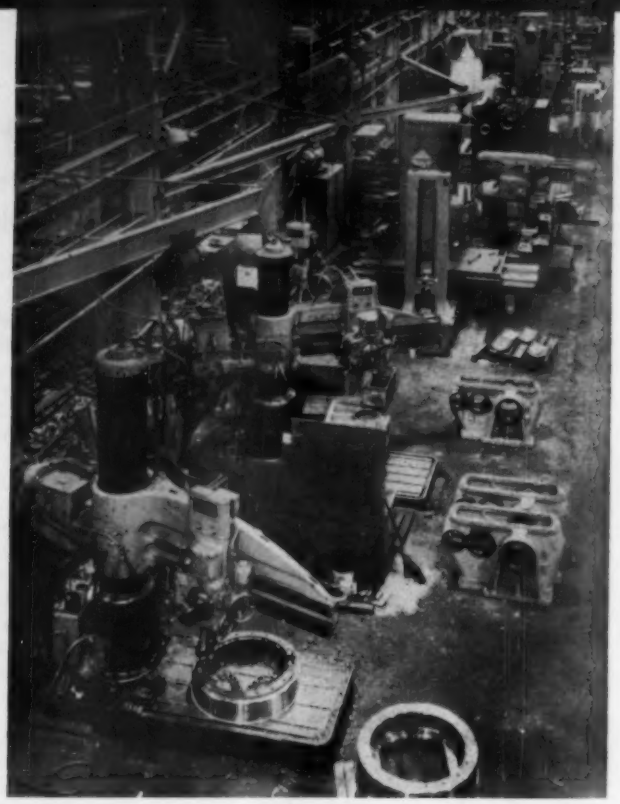
The comprehensive flooding timetable released earlied this month (OGJ, Mar. 9, p. 100), plus the actual evidence of slowing down or halting of subsidence, appears to have taken the pressure off navy threats to move the Huge Long Beach naval shipyard.

Rear Adm. Ralph K. James praised the steps taken thus far, but warned that the timetable had better be met "without missing one date" to keep the shipyard in Long Beach.

The Government's suit seeks compulsory repressuring or shutting in of the field and multimillion-dollar payment for subsidence damage to government installations. A Los Angeles federal judge early in the year denied a motion to dismiss the case.



NEW trailer-mounted mast being raised. Sections are telescoped in this position and remain so until the mast is vertical.



EXPANDED PLANT of Continental-Emsco includes this row of radial drill presses of various sizes. Plant additions were formally opened last week.

Continental-Emsco Shows Off New Rig

CONTINENTAL - E M S C O Co. made a surprise unveiling of a new trailer-mounted drilling rig during ceremonies marking a $3-million plant expansion at Houston last week.

The new rig, which will be shown to the industry at Tulsa's International Petroleum Exposition, is a step in a new direction for Continental-Emsco.

The company has long manufactured portable masts for mounting on conventional substructures, but the new T-97 is its first trailer-mounted mast. A two-trailer arrangement, mast and rig are rated to 7,200 ft. with 4½-in. drill pipe.

In addition to the trailer mast, Continental - Emsco has tooled to build other new oilfield product lines in the expanded H o u s t o n plant. Among these will be three new mud-pump styles. Bulk of the plant output, however, will be the company's established lines of rigs, pumps, masts, substructures, and pumping units.

The opening . . . Continental-Emsco

TOP OFFICIALS of Petroleos Mexicanos joined officials of Continental-Emsco Co. and Youngstown Sheet & Tube Co. in celebrating the opening of expanded facilities in Houston's Continental-Emsco plant. Left to right: S. A. Martin, plant manager; F. I. Brinegar, Continental-Emsco executive vice president (distribution); A. S. Glossbrenner, Youngstown president; Fernando Padilla, Pemex assistant managing director; William T. Powell, Continental-Emsco executive vice president (manufacturing and engineering); J. L. Mauthe, Youngstown board chairman; Pascual Gutierrez Roldan, Pemex managing director; and Frederick M. Mayer, Continental-Emsco president.

showed off its expanded facilities during 3 days of formal-opening events.

Crowds of visitors saw a plant area increased from 4½ to almost 8 acres and a plant site increased from 66 to 77 acres.

Enlargement of the Houston plant followed a decision by Continental-Emsco to close its Los Angeles plant and increase its manufacturing operations on the Gulf Coast.

Officials said the consolidation gives the company more efficiency by combining its engineering talent under one roof and taking advantage of the more centrally located Houston port for foreign shipments.

President Frederick M. Mayer of Continental-Emsco said 25% of the company's output is for export, and this figure will, if anything, increase.

The company expects also to diversify its operation by manufacturing some non-oil industry products.

The big increase, however, will be in oilfield equipment. Plant manager S. A. Martin estimated ouput will hit $40 million per year, compared with the present $18-20 million rate. The number of employes is expected to rise from 955 today to some 1,200 by year's end.

Optimistic outlook . . . With their expanded plant ready for operation, officials of both Continental-Emsco and its parent company, Youngstown Sheet & Tube Co., expressed confidence that the oil industry is moving out of the recession-plagued era of 1958.

Youngstown president A. S. Glossbrenner pointed to a "terrific increase" in demand for oil industry tubular goods, although the new demand came somewhat more slowly than the sweeping rise in steel output for the automotive industry.

The enlarged Houston plant marks another milestone in Continental-Emsco's 36-year history, which began in Los Angeles in 1923 under the name of Emsco Steel Products Co. After merging with Emsco Tool Co., a rotary-drilling equipment manufacturer, the company built its Houston plant in 1926.

Other mergers, including that with Continental Supply Co. in 1957, resulted in the present organization as a division of Youngstown.

The new rig . . . Continental-Emsco engineers are quite proud that the new T-97 mast uses no guy wires. Almost as soon as the mast is extended, they say, drilling can start.

The mast telescopes and folds to a horizontal position for moving. When it arrives on location, the mast is raised to vertical by draw-works power working through a sling line and a raising arm on each side of the mast. Once vertical, the mast is extended upward by changing sling lines and once again applying draw-works power.

When fully extended 97 ft., the mast is locked in place by latches roughly like those on a door. the latches are retracted with air pressure. However, it's impossible to do this accidentally. The mast must be raised several inches —something the driller can do only with a sling line in place—before the latches will retract and the mast telescope.

Draw works on the T-97 is a Continental-Emsco GB 250, a model already in wide use in other type rigups.

NEW SYNTHETIC TIRE is lifted out of mold by Ben S. Adams, factory manager, United States Rubber Co., as Dan W. Walsh, center, Pacific Coast sales manager, and J. P. Cunningham, general manager of synthetic rubber division, Shell Chemical Corp., look on.

Shell Claims Superior Synthetic

FIRST COMMERCIAL production of a synthetic rubber which duplicates the best grades of natural rubber was announced jointly last week by Shell Chemical Corp. and United States Rubber Co.

Claiming to be 2 years ahead of the parade, Shell is producing about 5 tons of polyisoprene rubber daily at its Torrance, Calif., chemical plant. During the year, output will be stepped up to about 10 times this amount.

Shell officials declined to reveal how the new sythetic is produced. Feed stocks are obtained by pipeline from Shell Oil Co.'s nearby Dominguez-Wilmington refinery.

Initially U. S. Rubber will use the new rubber only in truck tires. Production later will be expanded to include aircraft tires, tires for earth-moving equipment, white-sidewall passenger tires, and other products requiring high percentages of natural rubber. Synthetic rubber now supplies about 65% of the U. S. tire industry demand.

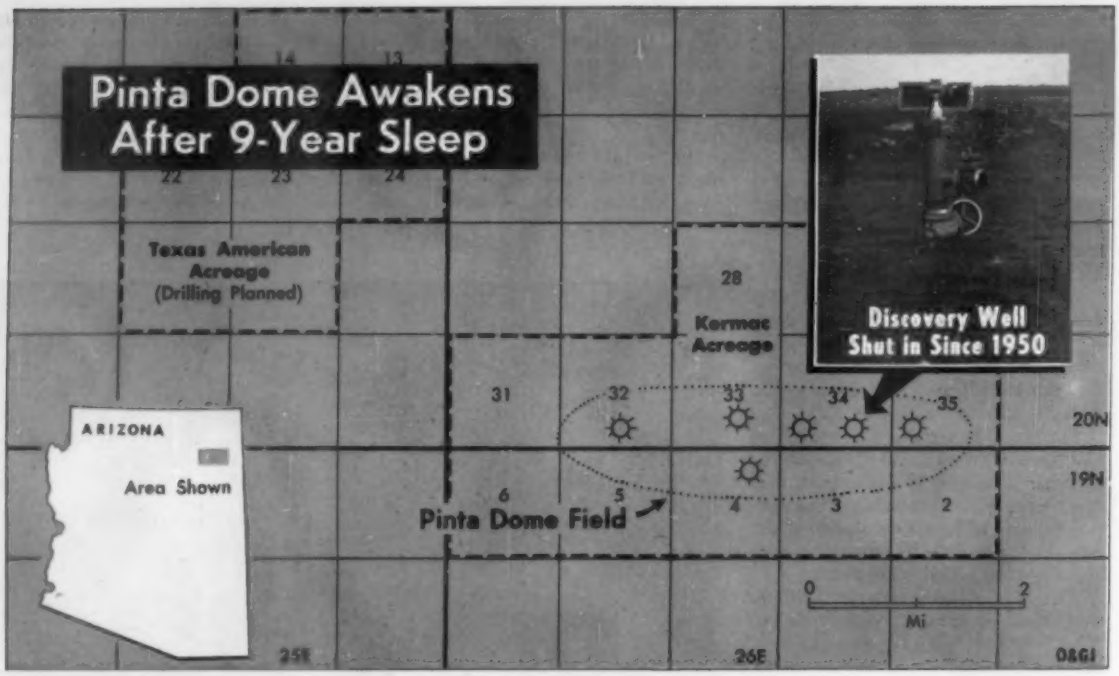
Natural rubber has been used in all large tires for both military and civilian use. Availability of polyisoprene rubber could free the U. S. from dependence on foreign sources of natural rubber in times of emergency.

Easier to process . . . Synthetic rubber is expected to have a stabilizing effect on natural-rubber prices.

It is more uniform in quality than tree-grown rubber, the companies claim. It also is easier to process. In some operations, tree-grown rubber must be strained of impurities before it can be used.

Other companies, including Goodrich, Firestone, and Goodyear, in recent years have announced the synthesis of polyisoprene. Until now it has not been produced commercially in this country, however. Russia is believed to have had a plant of about 5 tons daily capacity in operation for a year or more.

Price of Shell Isoprene rubber was quoted at 30 cents a pound (FOB, Torrance). This is about the same as the price for better grades of natural rubber and about 7 cents higher than the average synthetic-rubber price.



Helium Is Spurring Arizona Gas Play

• High helium content of Pinta Dome gas—at a time of zooming prices and demand for helium—is stirring the interest of operators in the area. Reopening of government extraction plant is being talked.

ONE OF THE strangest gas fields on the Continent, shut in and largely ignored for nearly 9 years, is at last kicking off a lease play in northeastern Arizona.

This is Pinta Dome field, named for the small community of Pinta, Ariz., just a mile and a half to the west.

Pinta Dome field was discovered in 1950 and has had six completed wells since 1951. The discovery well found two gas zones in the Coconino formation of the Permian at 780-810 ft. and 1,032-55 ft. The well came in prolifically for a combined open-flow potential of 66,000,000 cu. ft. of gas daily.

Why, with such large production at such shallow depths, didn't Pinta Dome start popping much earlier?

The answer is simple — the gas won't burn.

The gas found at Pinta Dome contains no methane, the principal component of natural gas. It does contain just about everything else—helium, carbon dioxide, nitrogen (89%), and traces of hydrogen, oxygen, argon, and light hydrocarbons.

The helium content of Pinta Dome gas, as a matter of fact, is the highest, percentagewise, of any known gas deposit.

And this is what is triggering the leasing and upcoming drilling activity in the area.

Pipeline outlet? . . . Prospects are good that Pinta gas will be processed for its helium.

The Pinta discovery well, the 1 Macie, in Apache County, was drilled by Kipling Petroleum Co. Kipling sold the well and its lease block in 1951 to Kerr-McGee Industries, Inc., which drilled, completed, and shut in five more producers on the block.

Helium content of the gas in the discovery, located in Section 34-20n-26e, checked out at 6.98% in the shallower zone, 8.09% in the deeper. (The U.S. Bureau of Mines figures it is commercially practical to extract helium from natural gas if the helium content is 2% of volume or more.)

Kerr-McGee is keeping mum about its Pinta Dome holdings and plans.

Informed sources, however, say that the helium content of the gas found by the five wells completed by Kerr-McGee is comparable to that in the discovery, though flow potentials varied.

The sources think it probable that the helium will be extracted from the Pinta Dome gas by a federal government-owned plant at Shiprock in northwestern New Mexico. The Shiprock plant currently is shut down following exhaustion of helium-containing gas it processed from Rattlesnake and Hogback oil fields in Northwest New Mexico.

Kerr-McGee reportedly has been negotiating with the Government recently whereby the latter would reopen this plant. Pinta Dome gas would reach the plant through a 135-mile pipeline, which, most likely, would be built by the oil company.

Independents jump in . . . Going price for helium is $15.50 an M.c.f. All of that sold is bought by the Government.

It is almost inevitable that the price of helium is going to go up sharply. There are two reasons for this. First,

most current helium sources are nearing depletion. Secondly, this comes at a time when helium demand is gaining strongly.

In 1957 total helium production in the U.S. was 292,000,000 cu. ft. The Government would like to hike this annual volume by 3 billion cubic feet. Although it now processes all helium production in the U.S., the Government relies on private industry to find the source.

Helium demand now, the Government says, is running about 360,000,000 cu. ft. yearly and gaining fast. The Government would like to outrun demand and stockpile helium in underground storage.

Some sources predict that helium prices, due to the current shortage and strong demand, may soon skyrocket to perhaps $45 an M.c.f.

Such predictions have played a strong part in the sudden interest operators are showing in Pinta Dome field.

About 2½ miles northwest of the field, Texas American Oil Corp., Midland, has assembled a lease block of 4,480 acres and plans to spud its first well about the first of April.

The Texas-American block, also in Apache County, is on a surface feature known as the Dead River structure lying just a few miles east of the Black Petrified Forest and Painted Desert. Nash Dowdle, president, says his firm's geological studies indicate prospects are bright that this structure will likewise produce helium.

Dowdle said Texas American has three locations in mind for its upcoming test — one in the southeast corner of Section 23-20n-25e, the others in Section 22-20n-25e. It will pick one before the end of the month.

To the northeast of Kerr-McGee's 23-section (13,720 acres) holding, J. G. Brown & Associates, another Midland, Tex., independent, has blocked out leases.

The geology . . . Geologically, the field and adjoining acreage lie on the southwest flank of the Defiance uplift which separates the San Juan basin on the east from the Black Mesa basin on the west.

The dome is a known surface structure which readily reflects the location and approximate perimeter of the presently developed producing area. Mapped on the top of the Chinle formation, the structure reportedly exhibits 60 ft. of maximum closure with 90 ft. of relative closure for the known producing area.

Production is from the Coconino sandstone of the middle Permian. The sand is fine-to-medium grained with porosity in the helium zone reportedly reaching an excellent 19-21%.

Why it's needed . . . Helium has come a long way from its former prime use to lift lighter-than-air craft.

It is odorless, inert, and cold-resistant, as well as being the lightest gas known.

Helium is invaluable in the atomic age, for instance, because it is the only known material that can be used as a nuclear reactor coolant without becoming radioactive.

It is proving highly useful, too, in low-temperature research due to its ability to withstand extreme cold. Of all the elements, helium permits the closest approach to absolute zero temperature.

Its miniature molecules make it valuable also as a leak detector. And it is finding increasing use as a guard against radiation leaks at atomic installations.

Helium's cold-resisting property is the base for the present commercial method of extracting it from other gases. A gas mixture containing helium is cooled until all other gases liquefy, then the helium drawn off.

Industry enters picture . . . The petroleum industry is becoming interested in helium in areas other than Pinta Dome, too.

The first helium-extraction plant to be built and operated by industry is due to go on stream in the next few months. It is already under construction at Sunray, Tex., 50 miles north of Amarillo, by Helex Co., a new firm organized by Northern Natural Gas Co., Omaha, and Air Products, Inc., Allentown, Pa. The plant will cost about $13,500,000.

Helium from this plant and another new one being built by the Government in Keyes field, Cimmaron County, Oklahoma, is expected to swell U.S. productive capacity to an estimated 900,000,000 cu. ft. a year.

Even so, the Government expects demand to surpass production from these plants by the early 1960's.

Second Deep Test Plugged

A CHAPTER in deep-well drilling ended in Pecos County, Texas, when Phillips Petroleum Co. plugged its 1-A Montgomery, the world's third deepest hole at 23,400 ft.

The wildcat was just 13 miles southwest of Phillips' 1-EE University, which last year became the world's deepest hole at 25,340 ft. This well was plugged several weeks ago after more than 2 years of drilling and testing.

Latest tests at the 1-A Montgomery were in the Wolfcamp, where perforations just below 10,000 ft. showed only a small amount of gas.

At the world's second deepest hole, Shell Oil Co. was testing the lower Pennsylvanian at its 5 Rumberger in Elk City field, western Oklahoma. This well, which was bottomed at 24,002 ft. last fall, recently flowed 3,000 M.c.f. of gas daily from shale while testing cement job on conglomerate perforations at 13,845-85 ft. After 18 hours, flow dropped to 300 M.c.f. daily. Only small amounts of gas were received in tests of the deeper Springer and Morrow sands.

Sun Plans Center

at Marcus Hook refinery to control product quality.

A NEW product-control center, believed to be the only one of its kind, is being set up to monitor continuously and directly the quality variances in important characteristics of petroleum streams.

The $100,000 facility will be completed by Sun Oil Co. at its Marcus Hook, Pa., refinery about mid-April. It will be located at a 60,000-bbl. unit which includes cat cracking, crude and vacuum distillation, visbreaking, and gas-processing operations.

Conventional instrumentation systems provide for monitoring and/or controlling processes based on measurement of secondary variables such as temperature, flow, and pressure. If these are controlled at predetermined levels the direct quality variables such as viscosity, color, boiling ranges, etc., should fall within tolerable limits.

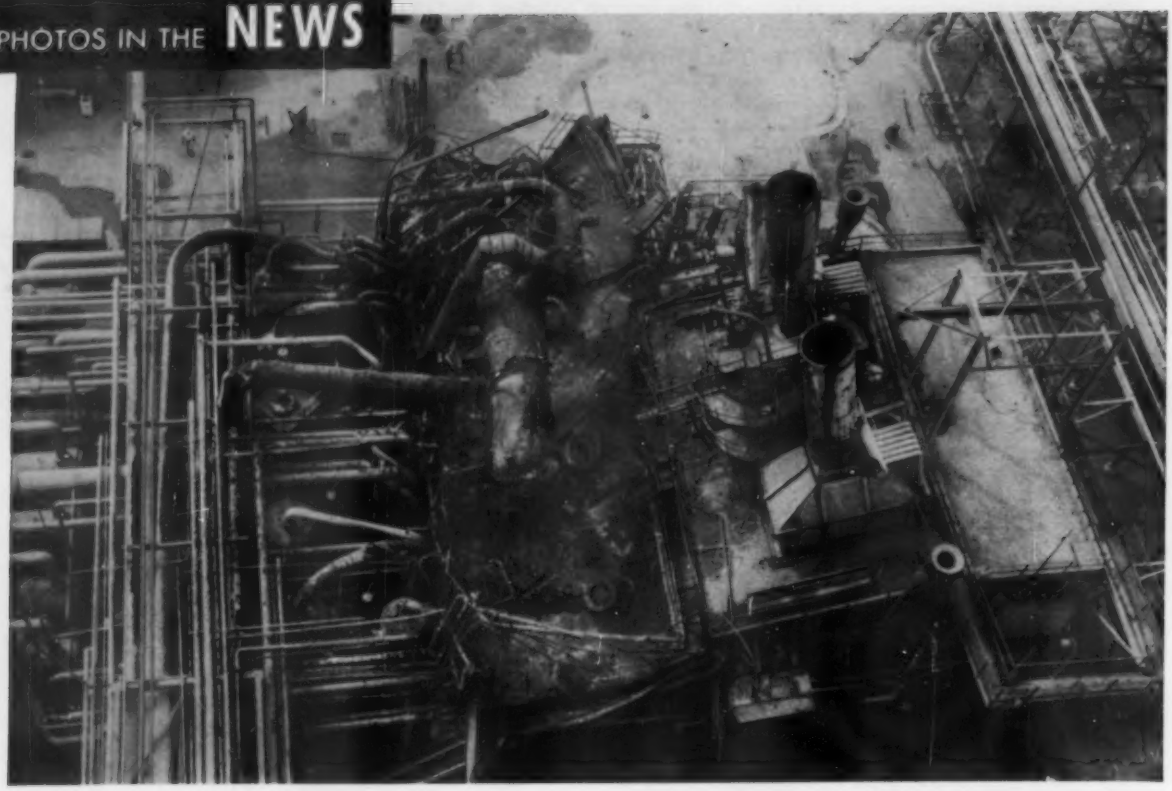
The new Sun control center does away with this indirect approach and measures directly by means of viscometers, continuous chromatographs, boiling-range recorders, density transmitters, colorimeters, and other such instruments. All are developed to analyze continuously or at short-time intervals.

The system will provide minute-by-minute data to permit the plant operators to make changes in small increments and better hold the products to specifications.

Equipment may be developed later which will use radiation signals to measure other processing factors such as liquid levels.

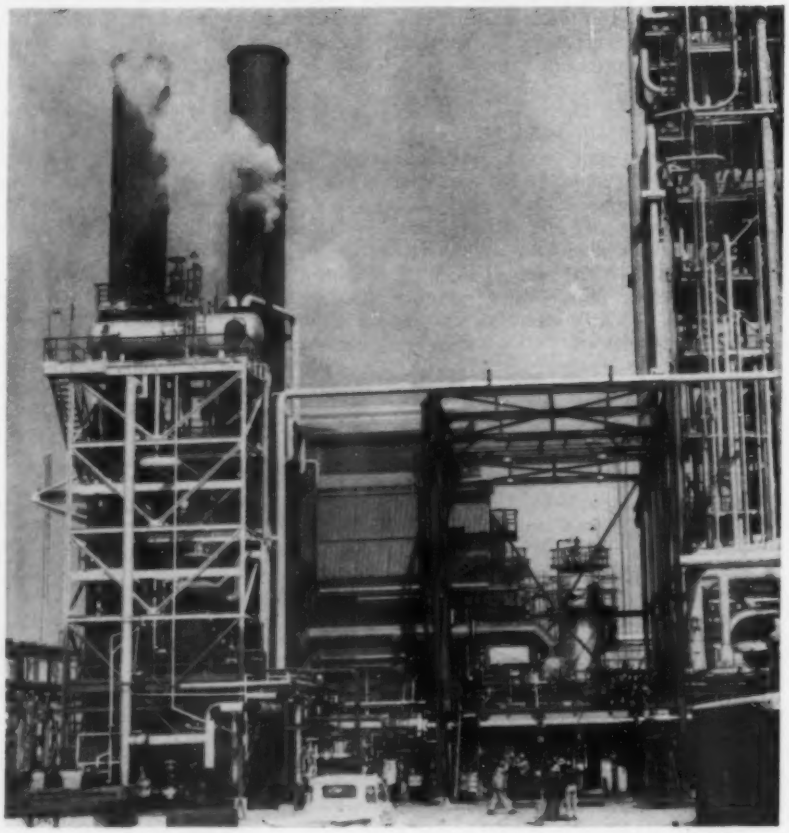
All information will be recorded automatically on charts or fed directly as electronic signals into a data logger with 100 input points and typed on sheets for reference. A computer is to be installed later to perform more complicated evaluations of these data.

PHOTOS IN THE NEWS



Before . . .

and After . . .→



Esso Standard's ethylene purification unit at its Baton Rouge refinery lay in ruins (above) on last October 1 after a fire and explosion in the compressor house.

But by February 13 all the units were repaired, back in place, and the plant on stream (right). The reconstruction job, normally a project taking 9 months to a year, was accomplished in 4½ months.

A special five-man committee coordinated the refinery-wide effort and had cranes moved into position to clear the wreckage before the fire was out. Besides refinery personnel, representatives and workers of equipment manufacturers and contracting firms helped. The compressors and turbines were repaired at the factories where they were made. They all were returned in time to be installed and hooked up in the repaired plant.

Air Lift Speeds Rig Over Guatemala Jungle

A pioneer wildcat in the interior of Guatemala will be spudded this week with airborne equipment and supplies.

Ohio Oil Co. moved some 4 million pounds of drilling equipment and supplies by the freighter Christiana from Houston to Puerto Matias de Galvez, Guatemala. From there the freight is air lifted to a jungle airstrip at Chinajo by flying boxcars. It is trucked to the drill site over a "switchback" road that climbs 1,000 ft. within 6 miles.

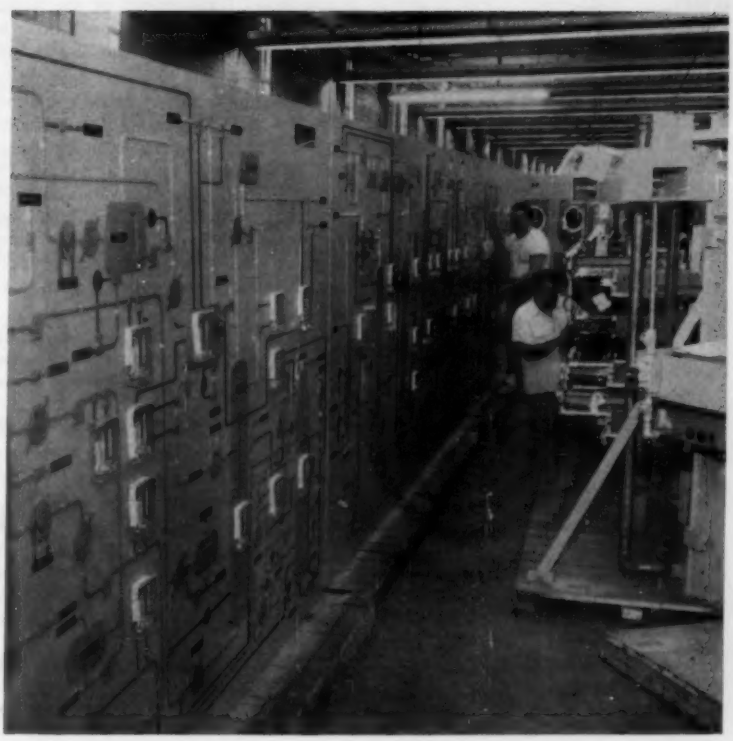
The wildcat will test the Arruga Grande anticline on a 109,539-acre unitized block owned by Ohio, Amerada, Continental, and Union. Before the well is taken to its contracted 13,000-ft. depth, a total of 6 million pounds of freight will be moved to the project.

Brazilian Refinery to Use King-Size Panel

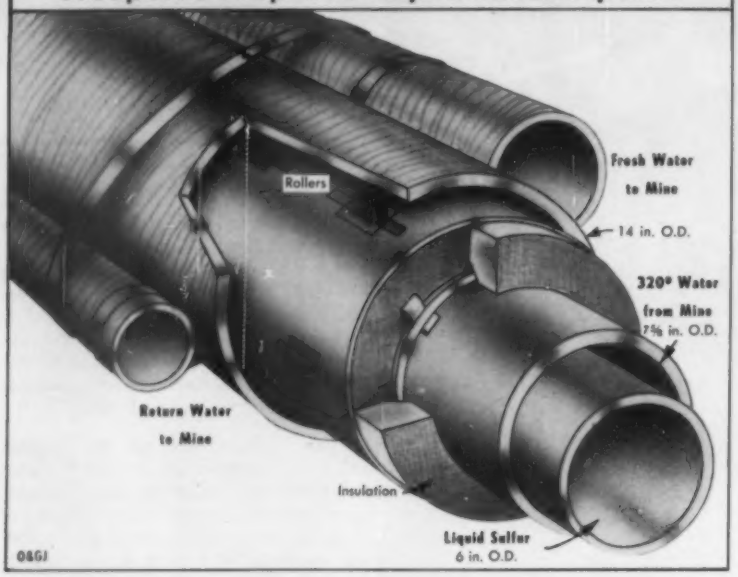
A 168-ft. control panel, in 24 sections, has been shipped from Philadelphia to a Brazilian refinery near Salvador in Bahia state. It is believed the largest refinery control panel ever built in the U. S. for export.

Refinery operations at Petrobras' Mataripe plant will be graphically portrayed on the instrumented panel with flow diagrams in color, enabling operators to tell at a glance what is happening at any point in the process at any time.

Instrumentation includes a large number of miniaturized pneumatic indicating, recording, and controlling devices, electronic potentiometers and flowmeters. The panel and its components were manufactured and assembled by divisions of Minneapolis-Honeywell Regulator Co.



Freeport's Proposed Liquid-Sulfur Pipeline



First Sulfur Pipeline Due

. . . for Gulf of Mexico. Freeport plans call for pumping molten sulfur through 7-mile line from an offshore mine.

FREEPORT SULPHUR Co. is preparing to lay a 7-mile sulfur pipeline in the Gulf of Mexico that should lift some eyebrows in the pipeline industry.

Freeport's line, which will carry molten sulfur from an offshore mine to the Louisiana coast, will consist of three concentric pipes, plus two others strapped to the sides.

The two inner lines will be made of high-tensile steel with a yield strength of about 60,000 psi., the first ever used on a pipeline.

Molten sulfur has never been transported in this manner. Freeport has come up with some ingenious engineering to overcome the problems of heat and expansion.

Contracts are to be awarded this month for the line, which will be laid on the bottom and buried later. Construction will start in May.

The pipe . . . The three concentric pipes will consist of a 14-in. protective casing, a 7⅝-in. hot-water-jacket line, and a 6-in. sulfur line (see drawing).

The inner lines will be of a special alloy never used before for line pipe. The 6-in. will be 0.288-in. wall weighing 17.57 lb. per ft., and the 7⅝-in. will be 0.328-in. wall weighing 25.56 lb. per ft. Some 400 ft. of the 14-in. casing will be of the same material, having 0.375-in. wall and weight of 54.57 lb. per ft.

Liquid sulfur at 320° F. will be pumped through the 6-in. pipe. Specially treated hot water of the same temperature will be pumped through the opening between the 6-in. and 7⅝-in. pipes.

Maximum capacity of the pipeline will be 4,500 long tons of sulfur per day, or 470 g.p.m., at a pump pressure of 900 psig. This will require 15 g.p.m. of hot water to overcome heat loss. If too much heat is lost, the sulfur may drop to its freezing temperature of 240°. If it is heated much above 320°, viscosity will become excessive.

Thermal insulation 2¼ in. thick will be placed between the 7⅝-in. and the 14-in. pipes. This will leave space for a small air gap.

Strapped to one side of the 14-in. casing will be a 4½-in. line to return the hot water to the mine for reheating and reuse.

Strapped to the other side will be a 6⅝-in. line to give additional supporting surface for the main line in the soft clay of the ocean bottom and also to supply fresh water for the mine.

High-strength pipe . . . One of the principal problems facing Freeport in building the line is overcoming expansion that occurs when pipe is heated.

The inner lines will not have expansion joints or loops. It will be handled instead by anchoring. The outer line will be anchored at each end. The inner lines will be fastened to the outer line after being heated to 225° F. and allowed to expand.

Freeport is eliminating expansion of perhaps 55 ft. which would normally result when the pipe is heated from atmospheric temperature to the high operating temperature.

Because of the unusual stress on the inner lines, the company has ordered high tensile steel pipe of 60,000 psi. strength. The outer 14-in. casing will be ordinary Grade B pipe because the stress won't be as great. Jones & Laughlin Steel Corp. is providing the high-strength pipe.

Ball bearings . . . Freeport has another innovation for the offshore pipeline —ball bearings.

The weight of the two inner pipes will be carried on ball bearing rollers spaced every 19 ft. along the line. These will make it possible to push or pull the lines through the casing with virtually no friction.

Freeport is expecting some expansion within the line because of the temperature variations, and the rollers will give freedom of movement to the pipe. Otherwise the insulation between the two outer pipes would wear out.

There is a good chance, too, that the rollers will work well enough that, if necessary, Freeport later could pull out the inner pipes and replace them.

Why the line? . . . Freeport has not yet started working its sulfur mine, located in Block 18, Grand Isle area, and it may be a year before full operations are under way.

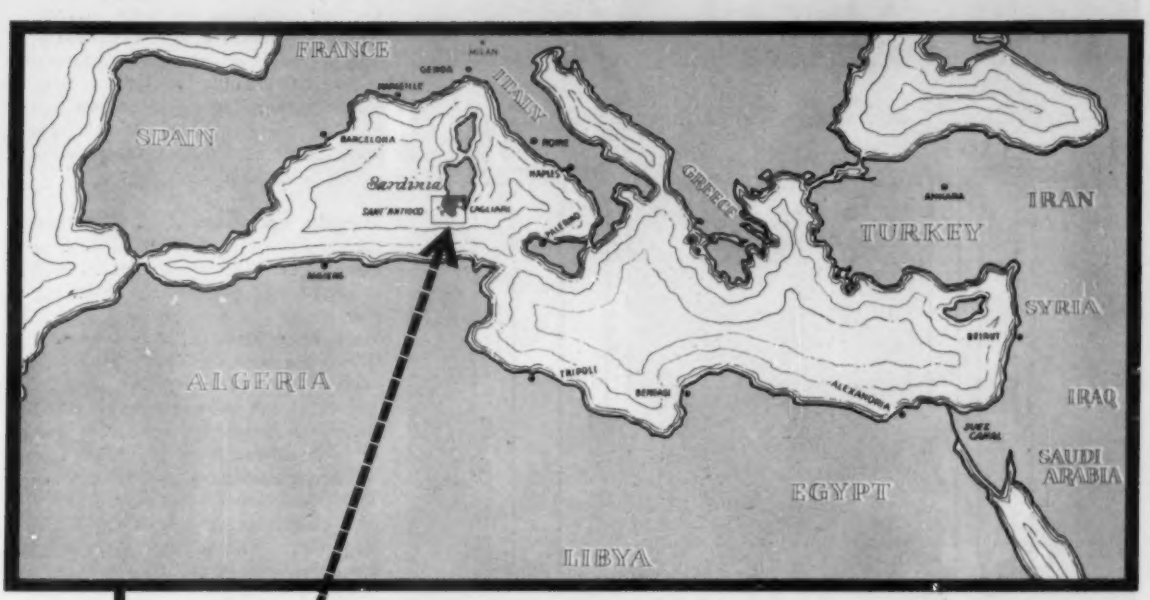
But the company decided in advance that barging sulfur to shore is risky and undependable because of heavy seas.

"We've learned that from the oil business," one company official said.

It was decided to build the pipeline to take the molten sulfur to the shoreline. There it will be picked up by barges in the protected waters of the Grand Isle land base and towed 25 miles along an inshore route to Port Sulphur for unloading. A pipeline all the way to Port Sulphur and an aerial tram also were considered.

Port Sulphur, 45 miles southeast of New Orleans, is the Mississippi River port where Freeport does its stockpiling and ships its production.

The new pipeline will have a capacity of several thousand tons of sulfur per day—sufficient to handle all that will be mined.



NOW: BAROID products direct from Italy

Baroid-Maffei S.p.A. now supplies the product BAROID* and other mud materials to oil operators in the Mediterranean and Middle East Areas direct from Italy. Baroid-Maffei mines, mills and ships BAROID from Sardinia to these areas. All products are processed under the world-wide quality control standards of Baroid Division.

Write or call Baroid Division, Houston, Texas or Baroid-Maffei, Milan, Italy for full details on products, port agent and maritime references.

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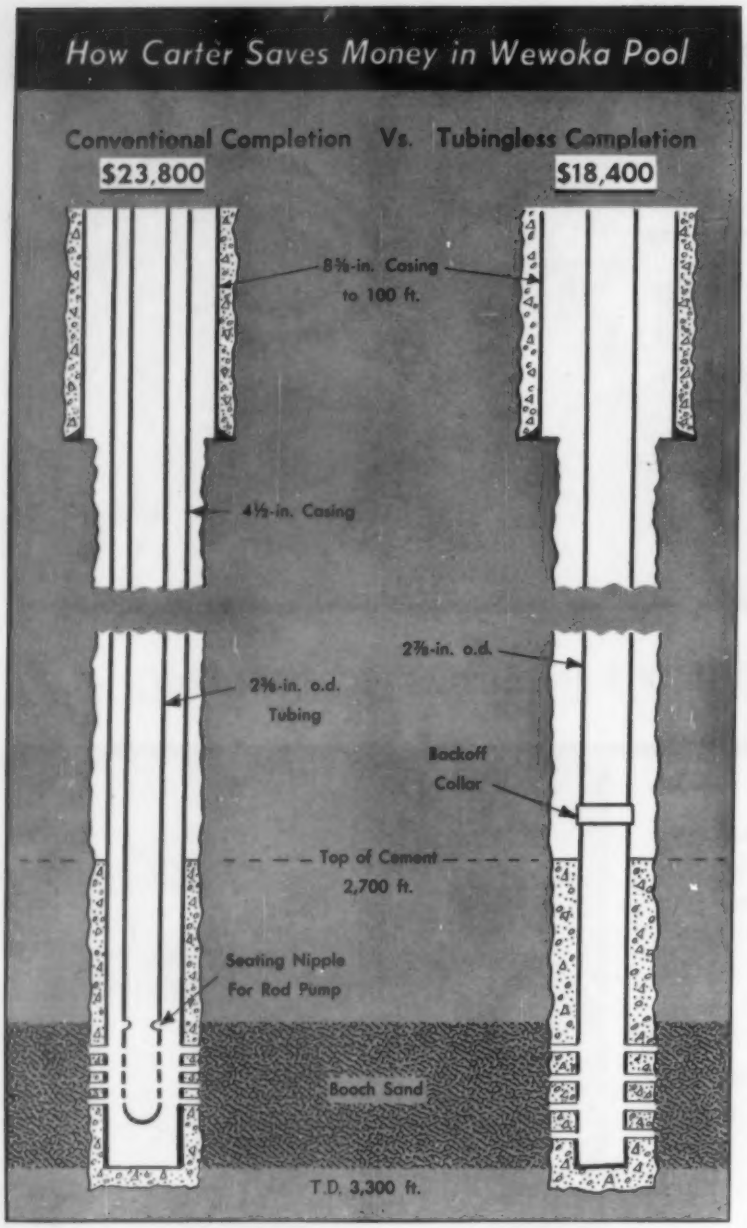


Completion Costs Cut

. . . by Carter in two Oklahoma fields. Tubingless method cuts casing needs and saves money on pipe-hauling costs.

TUBINGLESS COMPLETIONS are racking up sizable savings for Carter Oil Co. in two Oklahoma fields. Even more cost cuts are anticipated.

The tubingless technique is whacking more than one-third (34.7%) off the cost of completing shallow 1,100-ft. wells in Carter's secondary-recovery project in Washington County's Hogshooter field.

Completion costs are being reduced 22.6% on 3,300-ft. wells in the Wewoka pool in Seminole County.

So far, Carter has used the technique in completing three wells in the Wewoka pool and three wells in Hogshooter field for a total savings of more than $23,000. More wells are planned.

In addition to the savings, it means drilling some wells which couldn't be justified economically with conventional completion methods because of thin pay and low anticipated recovery.

As for possible workovers later, Carter is banking on a unique "insurance" measure which officials hope will enable them to pull the pipe out of the hole for repair.

Wewoka operations . . . The three tubingless completions have cost an average of $18,400—compared with an average of $23,800 for seven regular wells.

In both methods, the contractor drilled the same size hole—7⅞ in. So each cost the same per foot. Both use 100 ft. of 8⅝-in. surface pipe. About the same amount of cement is used in both, covering the bottom 600 ft.

The big savings is in tubular goods. The conventional wells have 3,300 ft. of 4½-in. casing and 3,300 ft. of 2⅜-in. tubing. The tubingless technique has only 3,300 ft. of 2⅞-in. casing as a production string.

In the tubingless well, the "insurance" in case of a workover is a backoff collar—with wide threads (6 threads to an inch)—above the cement. Carter is betting the backoff collar can be unscrewed to bring the pipe out of the hole.

It isn't too much of a gamble anyway. Harold Spiller, assistant division production manager in Carter's Oklahoma City office, points out if "one out of four is lost and we had to drill another hole, we'd still break even."

The three tubingless wells have an average flow potential of 601 bbl. of oil per day through a ⅜-in. choke. Only one of the convention wells in the field is rated above that.

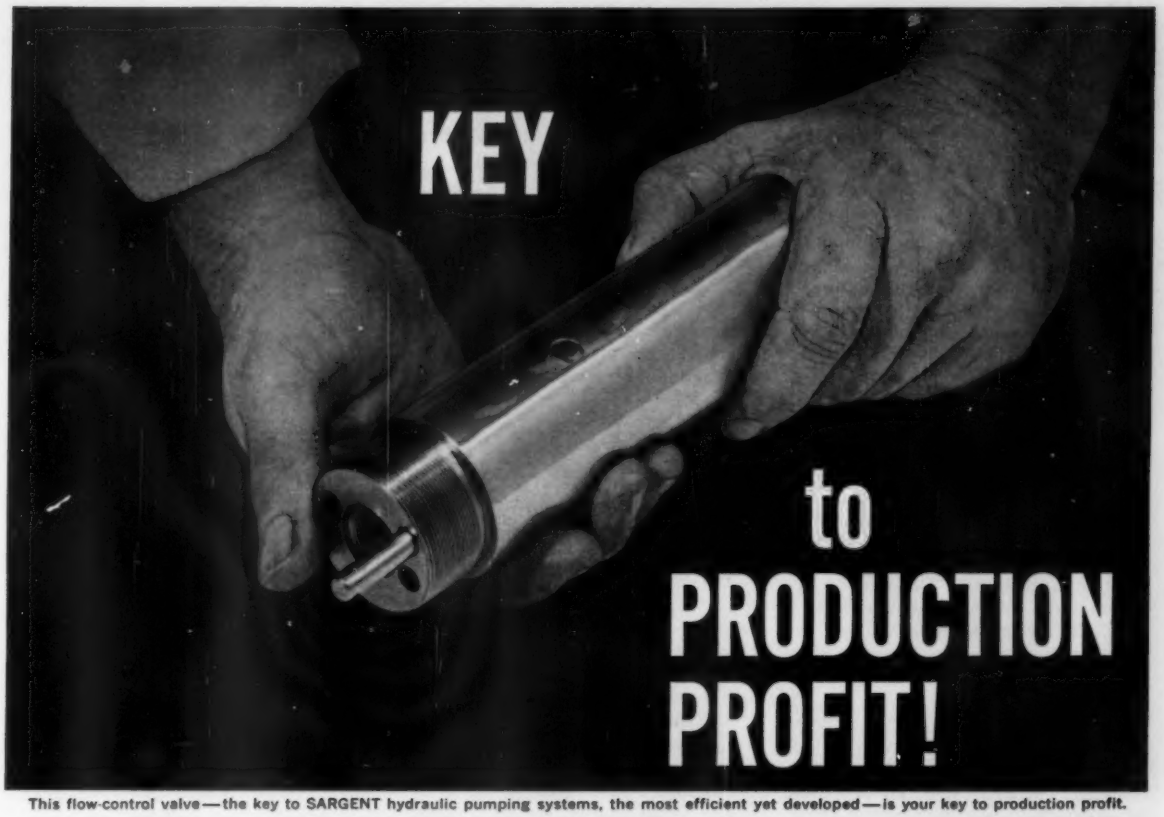
After 1 or 2 years of natural flow, Carter plans to pump the wells. Spiller says 1¼-in. tubing will be run inside the 2⅞-in. casing. "It will be pumped with a miniature pump with ½-in. sucker rods, which is plenty adequate to get allowables of 30 to 40 bbl. a day," he adds. The smaller pumping units also will mean a saving.

Hogshooter operation . . . Carter has used the tubingless technique in two water-injection wells and one producer in Hogshooter field.

Spiller says the average cost of the three wells is $4,500, compared with $6,900 for conventional wells.

The contractor drilled 4¾-in. hole to 1,100 ft. then cemented 2⅞-in. casing all the way to the surface.

Spiller says the small producer is on pump, using 1-in. tubing as a rod string. He points out this has limited application and is not planned for the Wewoka wells.



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WITH THE SARGENT FREE TYPE PUMP:

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Smog-Fighting Gasoline Claim

. . . made by Tidewater after 6 years research. Company says fuel designed for Los Angeles, offers it to others.

TIDEWATER Oil Co. last week shook the West Coast refining industry by announcing a premium gasoline which will reduce smog.

Tidewater told a big press conference the new fuel was tailor made for the Los Angeles Basin and was perfected after 6 years of research.

The new gasoline, Tidewater said, will fight smog three ways:

. . . **A vapor pressure** 2½ lb. below other premiums marketed in Los Angeles will cut evaporation 50% below gasolines previously refined.

This will curtail raw gasoline emissions into the air. If such gasoline is produced by all other Los Angeles refineries, more than 100 tons of hydrocarbons will be eliminated daily.

. . . **It is clean burning** and will result in better engine performance, thus cutting down on smog-making emissions.

By eliminating dicyclic aromatics from the reformate, deposits are reduced and engine efficiencies increased, Tidewater said. Though these compounds have a high octane value, they are bad gum producers.

Tidewater said it is eliminating 200 to 300 bbl. daily of these dicyclic aromatics from its 20,000-bbl. Platformer by redistillation of the reformate.

. . . **The olefin content** of the new 100-plus octane fuel was reduced "slightly." Tidewater said its olefin content is about 15%. Its premium fuel has been running about 17%, according to industry reports.

Tidewater said it is making "its findings public so that oil companies and smog-control officials may unite in a continuing campaign against air pollution."

Greater Use Seen

for acoustic logging tool. Panel cites it's accuracy.

ACOUSTIC LOGGING is much more accurate than is generally believed.

In fact, the margin of error is now less than 2% in most wells, a panel of experts agreed.

Acoustic logging is relatively new. It has been in general use less than 3 years, and there have been different estimates of its accuracy.

The small margin of error found in use of the tool should increase its demand, the experts agreed.

The panel appeared before the Geophysical Society of Oklahoma City. Moderator was A. Jack Oden, society vice president and seismic interpreter for Magnolia Petroleum Co.

Origins of error were revealed as temperature and pressure differentials, shale alteration, improper spacing between transmitter and receiver, cycle skipping, bore-hole cavities, depth errors, poor time breaks, the scale distortions.

Panelists pointed out that acoustic logging, including velocity and sonic types, is becoming more popular. Part of this is due to its multiple uses. It will provide velocity information, determine porosity, and give a high correlation value.

The panel included: Howard R. Breck, Seismograph Service Corp., Tulsa; W. B. Robinson, Gulf Oil Corp., Oklahoma City; Robert Nolting, Magnolia, Dallas; R. A. Broding, Century Geophysical Corp., Tulsa; Frank P. Kokesh, Schlumberger Well Surveying Corp., Houston; and Warren G. Hicks, Magnolia, Dallas.

The papers presented will be published by the Geophysical Society of Oklahoma City.

New Kenai Wildcat Planned

UNION Oil Co. of California will be operator on a test to be drilled on acreage held jointly with Ohio Oil Co. on Alaska's Kenai Peninsula.

The block is between Swanson River unit and Deep Creek unit. No spud date has been announced.

Farther up the peninsula, Halbouty Alaska Oil Co. was drilling below 8,036 ft. on its way to proposed depth of 12,000 ft. Halasko so far has run no logs but expects to do so below 9,000 ft. The well is 3½ miles southwest of Kenai's second producing well.

the JOURNAL *said . . . . . .*

50 years ago

March 20, 1909

General outlook for oil business in Oklahoma is much improved. The Texas Co. is enlarging its pipeline to southern points so it soon can handle 20,000 bbl. daily. Indications are good for reduction of freight rates on oil shipments to Texas. Gulf Coast crude prices have stiffened and more capital is ready for investment and expansion than ever before.

A new Dutch corporation, Union Petroleum Co., has been organized to purchase leases and production in Glenn pool. S. F. Van Oss of The Hague closed the deal in Tulsa with J. E. Crosbie.

C. H. Markham, general manager, and F. C. Proctor, general counsel to Gulf Pipe Line Co., arrive in Oklahoma from Pittsburgh for an inspection of lease holdings.

Robert McFarlin and Chapman brothers pay $30,000 cash for 20 acres of Highland Oil Co. property in the Flatrock area, north of Tulsa.

25 years ago

March 15, 1934.

Senator Capper of Kansas advises President Roosevelt he will introduce an amendment to senate's general revenue bill to kill the existing 1 cent a gallon federal gasoline tax. He said this adds $180,000,000 a year to an overtaxed industry, that gasoline taxing should be left to states, that the federal tax is unjust and outrageous.

Residents of Lloydminster, Saskatchewan, vote 241 to 13 to give Lloydminster Gas Co. Ltd., a 20-yr. franchise to serve natural gas to the community. The company's No. 1 producer, 1 mile north of the city limits, was the first commercial well in Saskatchewan.

Price-fixing by a state received implied approval of the U. S. Supreme Court in a 5 to 4 ruling upholding the New York milk price-fixing law of 1933. The parallel of the situation with the oil industry operations makes the decision a vital one, leaders say.

10 years ago

March 17, 1949

The greatest single accomplishment of the oil industry has been achieved in its oil and gas conservation, Hines H. Baker, Humble president, tells API in replying to U. S. Senate criticism of Interstate Oil Compact and Connolly Hot Oil law.

Full information from the U. S. Navy regarding the deal in which the Navy will get crude oil transported through the Trans-Arabian pipeline at cost for a 10-year period, is asked by Senator Wherry. IPAA asks if in the deal, the "military establishment" has agreed to perform any service, such as "protection and defense of properties."

A 21,000-sq.-mile Syrian oil concession has been granted James W. MenHall, Benton, Ill., drilling contractor and native of Syria. He plans a $100-million corporation to explore the concession.

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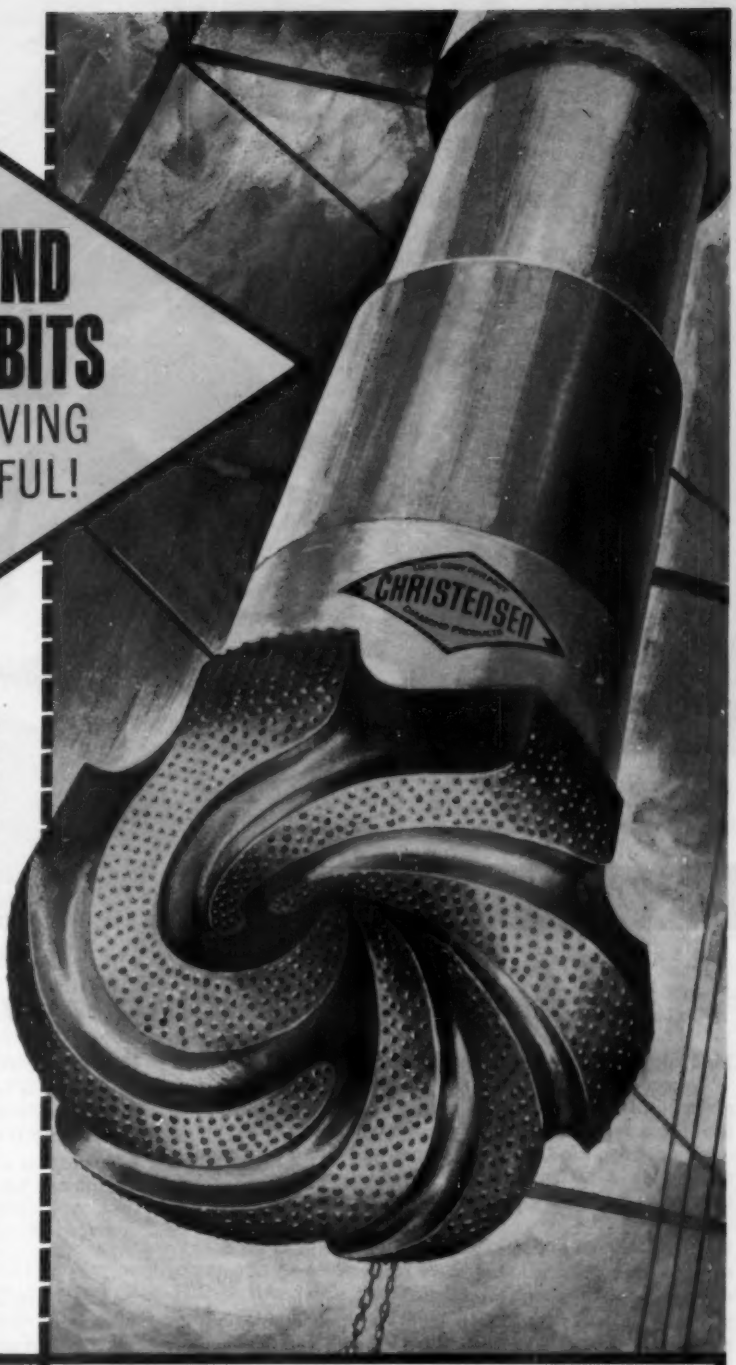

The introduction of the turbodrill has provided the oil industry with a tool of great promise. However, the turbo demands a bit that can absorb and effectively utilize its increased downhole power, one that can withstand high rotational speeds and increased fluid volumes. Diamond bits have long been known for their inherent long life and ability to increase penetration rates as rotational speeds increase. Because of these qualities, diamond bits have been tested with the turbodrill in many parts of the United States and Europe. Many thousands of feet have been drilled, and these tests have proven that under a wide variety of drilling conditions, the diamond bit-turbodrill combination can reduce drilling costs.

Christensen has accumulated data on the use of diamond bits with the turbodrill throughout the world, any portion of which is available to operators considering the use of this tool.

For detailed performance information about successful diamond bit-turbodrill applications, write or call Christensen Diamond Products. Ask for brochure number SD-650.

Diamonds Mean, "Less cost per foot."

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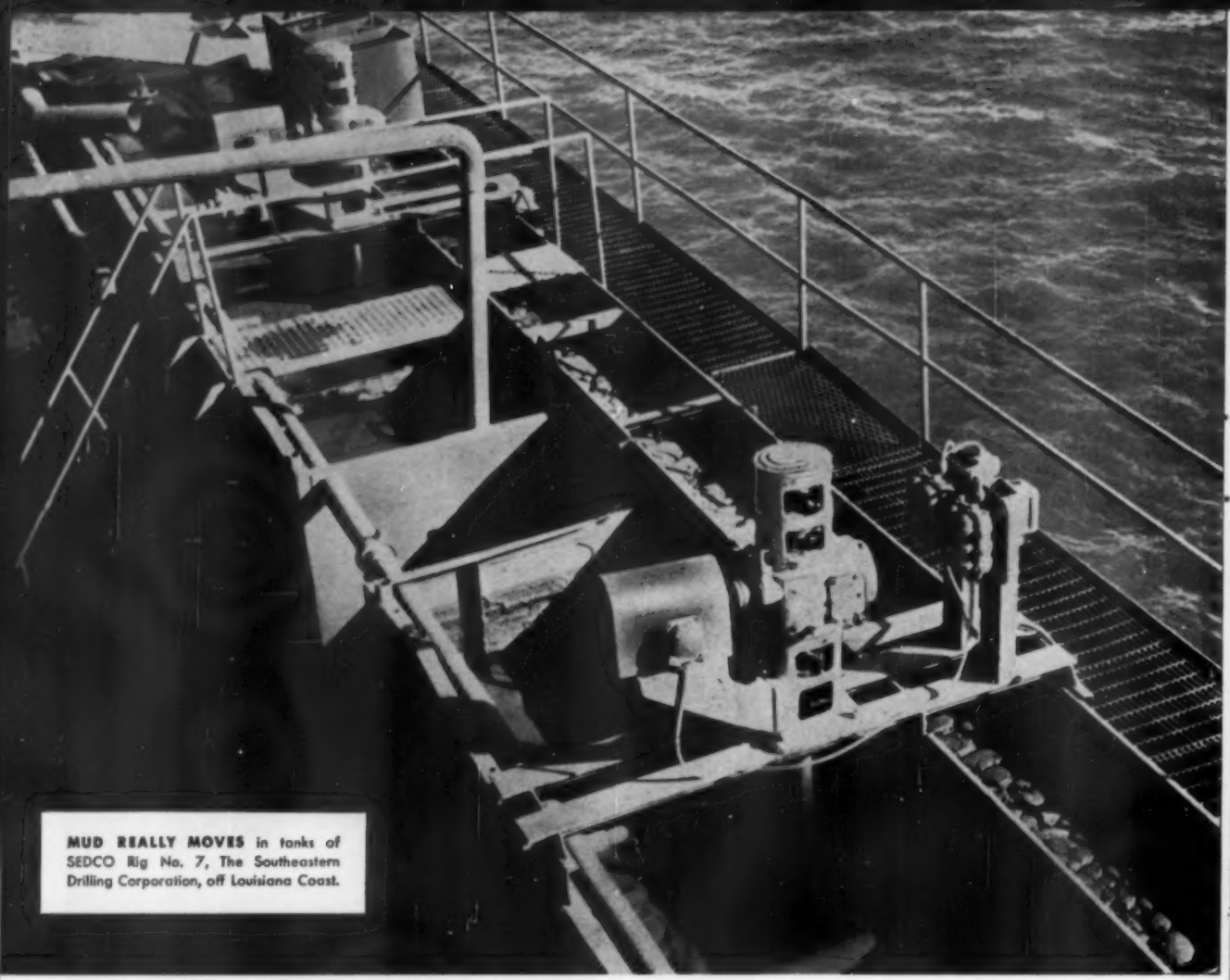

MUD REALLY MOVES in tanks of SEDCO Rig No. 7, The Southeastern Drilling Corporation, off Louisiana Coast.

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Mud control is one place where you can.

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As a first step to more productive drilling, see for yourself what LIGHTNIN Mixers are doing on rigs near you. Your LIGHTNIN representative will gladly arrange a field trip if you call him now. He's listed in Composite Catalog. Or write us direct.

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Seaton Blasts Plan

of New Mexico group aimed at sale of federal lands.

SECRETARY of the Interior Fred A. Seaton is flatly opposed to a plan by the New Mexico Land Resources Association to transfer 200 million acres of public lands in the West to state and private ownership.

Seaton termed the proposal a "big land grab which would involve federal lands in speculation."

"I am interested in the proper sale or exchange of federal land under the right conditions," he said. "But in all cases it should be the people—those who really own the land—who benefit by the sale or exchange."

The association, a private organization of New Mexico business men, proposes to reduce federal land holdings in the 11 western states by at least one-half. The group, which includes oil and gas interests, plans to call for purchase of the federal lands by the states on long-term payments at low interest rates. The land would then be resold by the states to private owners under similar financing.

The association reportedly also plans to open a campaign to obtain for the states 90% of oil and mineral royalties from federal lands. The states now receive 37.5%, with the remaining 52.5% going to the federal Government for western reclamation projects.

The interior secretary said some of the plan's provisions appear to parallel legislation his department will take to Congress this year.

"One bill would deal with disposition of federal lands to municipalities, states, and in some cases to private enterprise," Seaton explained. "What it amounts to is an updating of old land laws."

Gulf Cuts Purchases Again

GULF OIL CORP. confirmed last week that it has prorated its purchases in Louisiana at 65% of the March allowable.

Original announcement of the cutback came from Louisiana's conservation commissioner, Ashton Mouton.

In Houston, Gulf did not elaborate on the announcement but confirmed it. There also was no indication when prorating of buying in West Texas, Southeast New Mexico, and Alabama would be lifted.

The original prorationing occurred because of a strike at the 275,000-bbl. refinery at Port Arthur. The plant is now back in operation.

The buying cutback in Texas, New Mexico, and Alabama, started in early February, amounted to about 121,000 bbl. daily. The new move will reduce the take in Louisiana from 145,000 bbl. daily to about 95,000 bbl. daily.

Hoffa Is Opposed

by Gulf Coast union leaders in new organizing efforts.

EFFORTS of Teamster President James Hoffa to gather the Esso Standard Oil Co. refinery at Baton Rouge into his union empire are being sharply opposed—both by AFL-CIO leaders in Louisiana and by the Oil, Chemical, and Atomic Workers Union on the Gulf Coast.

Hoffa had a scheduled meeting late last week with the 4,000 refinery workers at Baton Rouge to invite them into the Teamsters Union.

The Esso employes are represented by the Independent Industrial Workers Association.

At Houston, J. Elro Brown, OCAW district agent for the Texas and Louisiana Gulf Coast, said his union is ready to do battle with the teamsters in any organizing effort.

Hoffa's projected visit to Baton Rouge touched off a blast from AFL-CIO leaders in Louisiana. Victor Bussie, president of the Louisiana State Labor Council (AFL-CIO) said bluntly that Hoffa represents "everything that decent law-abiding union members are opposed to—corruption in labor, contempt for law enforcement, disregard for public opinion and welfare, and dictatorial control of union members."

INDUSTRY BRIEFS . . .

Tidewater is moving its central division from Tulsa to Houston for consolidation with its southern division. Tidewater said there will be no reduction in personnel and the 250 to 300 Tulsa employes will be moved to Houston during the next several months. E. B. Miller, Jr., southern division head, will be vice president and general manager of the new combined division. Lloyd Armstrong, head of the central division, will be vice president and assistant general manager of the new division.

Coastal Crude Oil Co., a marketer of crude, has been organized in Houston by Merle S. Keffer, former manager of supply and transportation for Texas City Refining. Keffer also formerly was associated with Indiana Oil Purchasing for 11 years.

Possibility of merger has been discussed between Buttes Gas & Oil, Oakland, Calif., and Occidental Petroleum, Los Angeles. But O. G. Green, Buttes president, said nothing definite has been decided. Buttes has gas production in Sutter and Tehama counties. Occidental oil production averaged about 880 bbl. daily last year in California.

The federal grand jury's investigation of alleged price-fixing in the Denver area was recessed indefinitely after 6 days of secret hearings. The probe stems from a 4-month-old gasoline price war in the Denver area. The jury sessions are expected to resume as soon as government attorneys complete study of records submitted by oil companies. The jury heard 25 witnesses from among nearly 40 oil-company officials subpeonaed to testify.

An oil and gas lease sale may be held in June or July by the Board for Lease of University of Texas Lands. The board has asked operators to submit lists by April 11 naming tracts they would like to have put up for bids. Operator response will determine whether or when a lease auction will be scheduled.

Producing Properties, Dallas, has purchased an undivided interest in 17 wells in Oceanic Penn field in Howard County, Texas, for $400,000. Company also has bought full working interests in two gas wells in Duval County, Texas.

Frankfort Oil, Dallas, has acquired 418,000 acres of developed and undeveloped leases in Colorado, New Mexico, and Kansas from D. D. Harrington, Amarillo independent. Along with the acreage, Frankfort gets five unconnected gas wells.

The Interior Department has distributed $14,966,944.75 to 22 states as their share of proceeds from federal mineral leases for the second half of 1958. Payments represent the states' share of more than $38,543,000 in bonuses, royalties, and rentals from federal mineral leases within their boundaries.

A PORTABLE neutron multiplier is operated in Russia, as . . .

Reds Push Scientific Oil Hunt

. . . with atomic devices similar to those used in the U. S. The atom also is being used in pipelining and refining.

OIL FINDING by the radioactive halo or some similar thesis is getting a tryout in Russia.

The Russians also are using in the field a midget portable neutron multiplier, a variety of atomic reactor, which gives on-the-spot elemental analysis of rock samples.

These adaptations of the atom to the oil industry— variations of which have had general use in the United States, Canada, England, and elsewhere—indicate how intensely the Russians are pushing the science of oil finding and production.

They also are using the more familiar electric logging techniques, employing gear developed by the USSR Academy of Science.

The radioactive surveys are being made from planes equipped to register and record changes in irradiation. When a line traced by a precision instrument falls, then rises, the Russians say they may have a clue to an oil field.

Information on the method is skimpy. It is not known how long the technique has been in use there or what the Russians think of it in comparison with gravity and magnetic surveys.

The possibility that a halo of radioactivity surrounds many oil fields was suggested 7 years ago by Hans Lundberg, who made a study of Redwater field, Alberta, and Coalinga field, California. Another study of the same data gave another explanation of the radioactive anamolies, and Lundberg's theory did not win wide acceptance.

Russians say the portable neutron multiplier is proving its worth in operation. They hint they are working on a smaller model to go down the hole and lessen the need for cores.

The atom also is being employed in pipelining, where gamma density meters are in use. Refining laboratories are making use of radioactive isotopes and experiments are under way on chemical oil synthesis.

PROCESSING BRIEFS . . .

A fuel-oil research project has been launched at Battelle Memorial Institute, Columbus, Ohio, under a new agreement with American Petroleum Institute. The 12-month program is designed to seek new and better oil-burner equipment and to coordinate industry research. The study will be supervised by the fuel-oil committee of API's Division of Marketing. D. W. Locklin of Battelle's mechanical-engineering department will be full-time coordinator of the program.

Two new steam generators are to be installed at the Port Credit refinery of Regent Refining (Canada). Estimated cost of the two 50,000-lb.-per-hour generators is $560,000.

Synthetic zeolites or molecular sieves are being used to extract water from kerosine-type JP-4. The process has been proved by Linde Co. division of Union Carbide in tests at Armour Research Foundation. Armour laboratory reports the process reduces water content of the fuel to zero parts per million.

The first edition of a manual on electrical installations in refineries is now available through the American Petroleum Institute. Copies of the manual, RP 540, may be obtained for $2 a copy from the Publications Department, API, 50 West Fiftieth Street, New York 20, N. Y.

Texaco has started construction of a sulfuric acid-alkylation unit at its 13,000-bbl. El Paso, Tex., refinery. The unit will have capacity of 1,600 bbl. of high-octane alkylate daily. Completion is scheduled by the end of the year.

Also for Refiners . . .

IN THE NEWS: Mandatory controls will cut total imports by about 270,000 bbl. daily or 15% below 1958 levels (p. 69) . . . California's independent refiners hail Union Oil's price slash, which so far has not been met by competitors (p. 74) . . . Synthetic rubber which duplicates best grades of natural claimed by Shell (p. 77) . . . Sun sets up new product-quality control center at Marcus Hook (p. 79) . . . Tidewater claims it has developed premium gasoline which will reduce smog (p. 86) . . . Italians start work on Europe's largest petrochemical complex (p. 95).

PLUS THIS TECHNICAL REPORT: The WPRA refining quiz deals with alkylation (p. 167).

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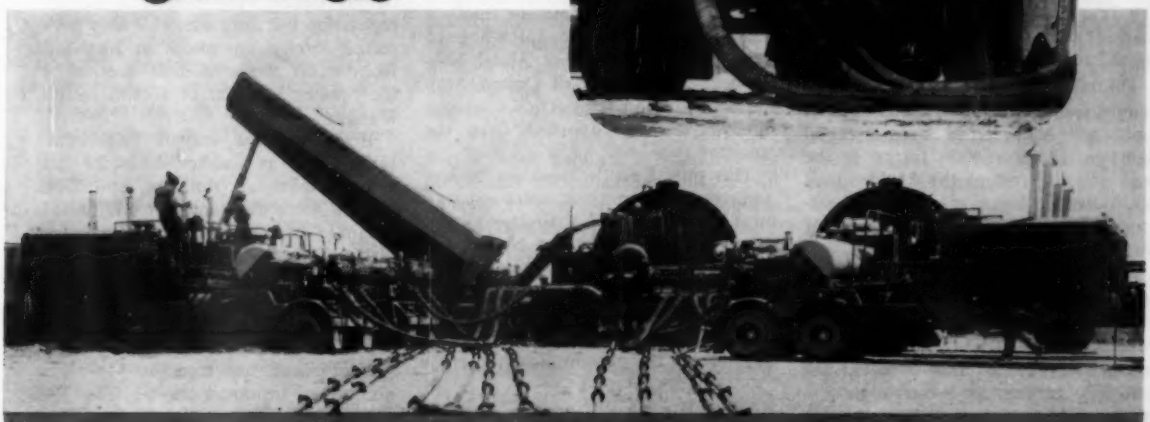
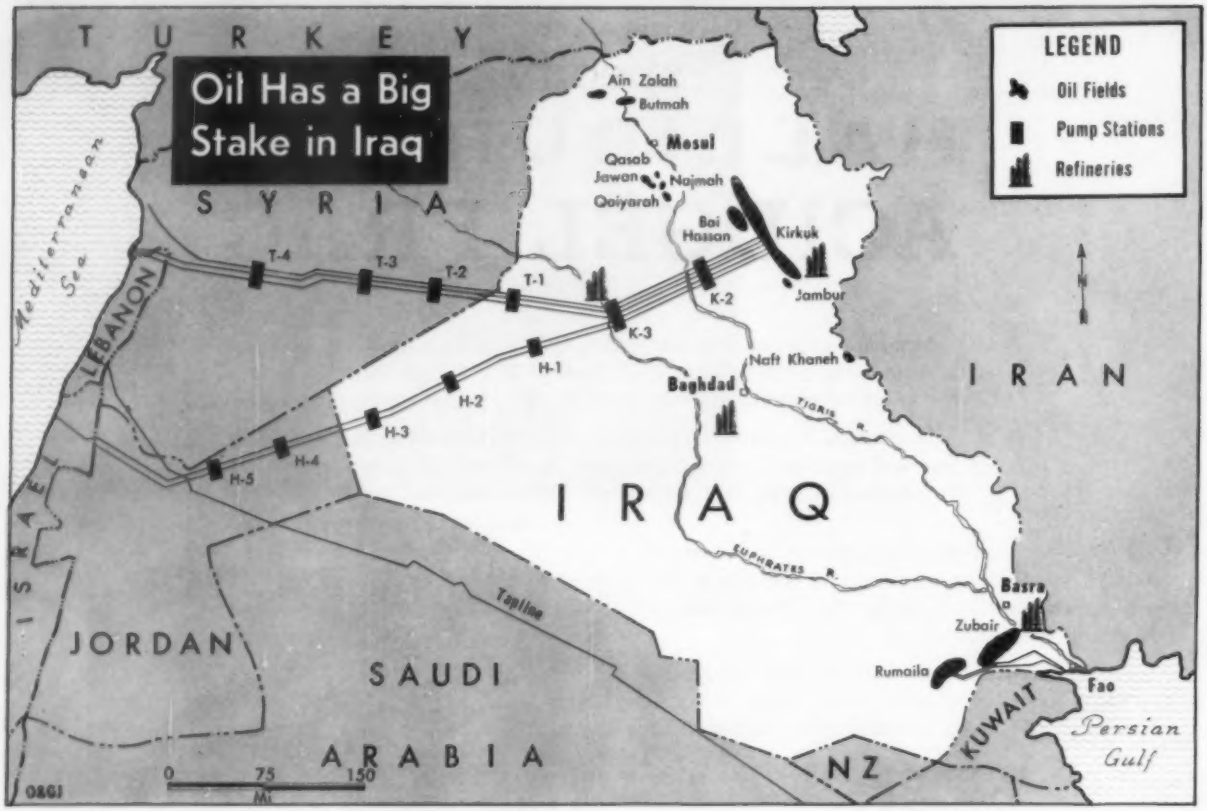


"CONTINUE TO LOOK TO HALLIBURTON—FOR LEADERSHIP"



Oil Industry Sees New Power Struggle

• Revolt in Iraq points up threat of Russian influence spreading over an important source of oil for Europe.

A REVOLUTIONARY brush fire was put out before it ignited tinder-dry Iraq last week, but the upheaval made it clear that a new chapter has started in Middle East power politics.

Oil installations that handle crude production in excess of 700,000 bbl. daily are believed to have escaped damage. The long-term future of the Iraq and the rest of the Middle East oil industry, however, could be affected by the short-lived revolt of disenchanted Iraqi army officers.

The 8-month-old central government of Premier Abdel Karim El-Kassem, by quickly putting down the revolt in northern Iraq, apparently escaped the bloody fate it meted out last July to the pro-Western government of King Faisal. Ironically, the new revolt was led by one of the plotters who overthrew King Faisal. This was a 40-year-old artillery officer, Col. Abdel Wahab Shawaf.

But the Iraqi Government made it clear that it saw the influence of Egypt's President Gamal Abdel Nasser behind the plot. All United Arab Republic diplomatic officers except three have been expelled from the country.

This puts Egypt's President Nasser and Iraqi's Premier Kassem into almost open rivalry. A similar rivalry existed between President Nasser and the government of the now-dead King Faisal. The difference is that King Faisal leaned to the West for support. Premier Kassem is leaning heavily on the communists.

What happened . . . The revolt apparently was a spontaneous move led by Col. Shawaf.

A complicated web of personalities, however, indicates the leaders had strong sympathies for the Pan-Arab Union favored by President Nasser.

Col. Shawaf was from a member of a wealthy, land-owning, and religious family. He earned a modest reputation last July when he ably protected foreign embassies in Baghdad from street mobs. A half brother is the present Minister of Health in the Kassem cabinet.

Brig. Nadhina Kamel Tabakchali reportedly was another leader of last week's upheaval. Both he and Col. Shawaf were classmates of Col. Abed Salam Arif, who with Kassem led last year's revolution. Col. Arif favored merger with the United Arab Republic. He is now under death sentence on charges of plotting against the life of Kassem.

The revolt centered in Mosul, a secondary headquarters of Iraq Petroleum Co. Sharp fighting was reported, and the government bombed the town by air. The U.S. State De-

A Quick Look At Iraqi Oil

PRODUCTION averages about 800,000 bbl. daily, making Iraq the fourth largest producing country in the Middle East, outranked only by Kuwait, Saudi Arabia, and Iran.

PIPELINES operated by Iraq Petroleum Co. are moving about 500,000 bbl. of crude daily from Kirkuk and smaller fields in northern Iraq to the Mediterranean and about 250,000 bbl. daily from southern fields to the Persian Gulf.

OWNERSHIP of the IPC is held by British Petroleum, Royal Dutch-Shell, Cie. Francaise des Petroles, and a joint Socony Mobil and Jersey Standard company, each with 23¾%. The Gulbenkian Estate holds the remaining 5%. IPC owns the two other operating companies in Iraq, Mosul Petroleum and Basrah Petroleum.

in Middle East

partment advised 1,100 Americans in the country to stay off the streets.

The fate of the rebels late last week was a question mark. Baghdad said Col. Shawaf and other leaders had been killed. Other reports said they were fighting their way to the Syrian border.

What it means . . . The downfall of King Faisal last year was viewed as President Nasser's biggest triumph in his dream to build an Arab empire powered by oil.

The question at the time was when and where his followers would next strike to bring another country into the Nasser camp.

The Kassem government refused to dance to Nasser's tune, however. Instead, it has sought to bolster its independence by closer cooperation with Russia. In line with this policy, an Iraqi delegation in Moscow has tied down an aid agreement for at least 20 development projects.

Observers believe local communists are trying to keep a wedge between Egypt and Iraq in preparation for the day the country may become a virtually Red satellite. This would mean Russian domination of an important source of European oil and a strategic foothold on the borders of Kuwait and Saudi Arabia. Russian technicians are expected to start entering Iraq in connection with the present development programs.

Oil operated without interruption during and after last year's revolutions. Crude production averaged 727,000 bbl. daily last year, and in individual months output has hit more than 800,000 bbl. daily.

About 500,000 bbl. daily is moved through IPC pipelines to Mediterranean terminals in Syria and Lebanon. Except for local consumption, the rest of the oil is shipped from Fao on the Persian Gulf.

IPC in its negotiations with the new government agreed in principle to give up some of its concession lands, which could then be offered to other companies. It also is pushing a development program. Pipeline and field-development programs will permit shipments of 700,000 bbl. daily to the Mediterranean next year. A new terminal at Fao will permit lifting of 440,000 bbl. daily from southern fields (OGJ, Feb. 16, p. 100).

Big Middle East Pipeline Set

. . . for action at Cairo Arab meeting. It would cost $560 million, move crude from Persian Gulf to Mediterranean.

ARAB COUNTRIES are drawing up plans for a big-inch pipeline system from the Persian Gulf to the Mediterranean Coast.

The $560-million line would carry crude from Saudi Arabia, Kuwait, and Iraq to a terminal in Lebanon or Syria. The Arab League oil committee is in session studying the project from technical, legal, and economic points of view.

Plans for the system may be one of the biggest topics of the oil conference in Cairo in April. Reports from the Middle East indicate informal talks carried on with oil companies over an Arab-owned pipeline have been promising.

If the system is built, feeder lines from Saudi Arabia, Kuwait, and Iraq will feed crude into a trunk line probably running to Tripoli, Lebanon, or Banias, Syria. No decision has been made on diameter of the line. But the project presumably would replace a dormant plan of oil companies to build a 40-in. line designed to move 800,000 bbl. daily. Capacity of this size line could later be doubled.

Bigger Arab role . . . When the oil committee completes its plans, it will present them to producing and transit countries for approval.

The next step will be to set up a pipeline company with modest capitalization. The headquarters will probably be located in the country which puts up the most money.

Arab League officials appear confident that the $560 million for the system can be raised from Arab governments and individuals. A loan from the World Bank and Iranian participation in the program may be sought to help out. But the Arabs hope to finance the system without oil company capital.

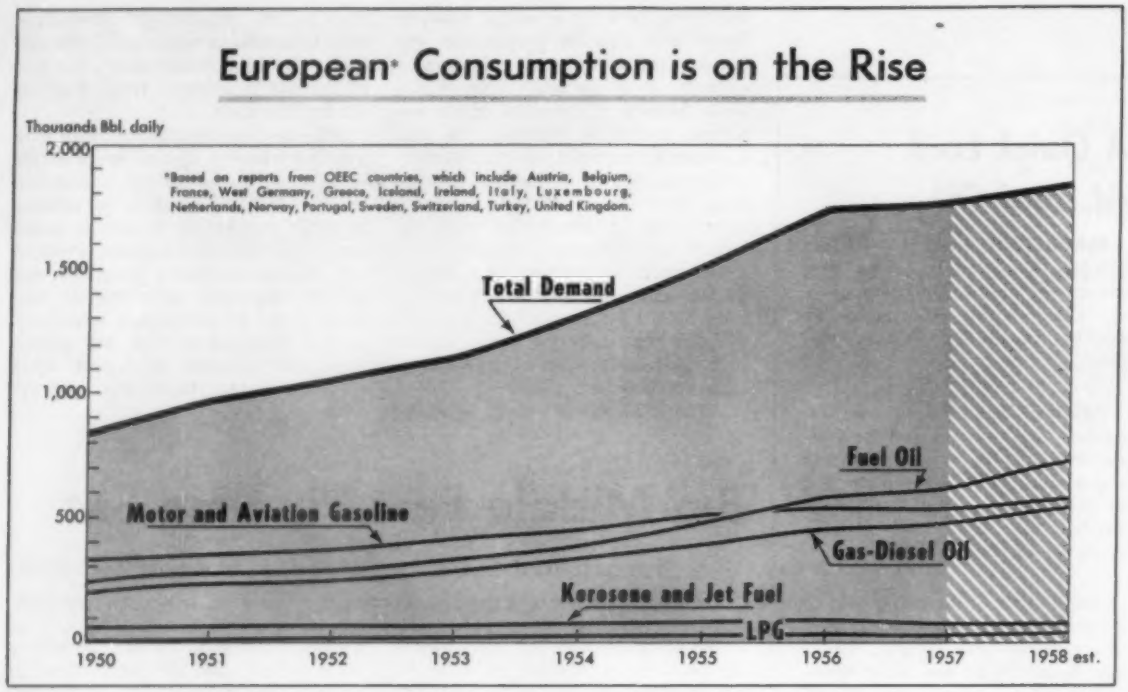
The project is in line with the desire of Arab countries to have a bigger role in the operation of the local oil industry. Because the system would be Arab-owned, it might be more secure from sabotage. Arab ownership might also end bickering among transit countries over right-of-way fees.

More than 900,000 bbl. daily is already moved by pipeline to the Mediterranean. Trans-Arabian pipeline last month supported deliveries of 431,400 bbl. daily of Saudi Arabian crude from Sidon, Lebanon.

Crude output up . . . Iraq Petroleum Co. moves about 500,000 bbl. daily from Kirkuk and other fields in northern Iraq to Tripoli, Lebanon, and Banias, Syria. An expansion program is under way which will increase the capacity of the IPC system to 700,000 bbl. daily next year.

A proposal for a 40-in. system from the Persian Gulf to the Mediterranean, possibly to a terminal in Turkey, received wide attention 3 years ago when the Suez Canal and IPC pipelines were disrupted. Companies put the project on the shelf, however, when the canal reopened and a tanker surplus sent shipping rates tumbling.

The Arabs believe that increased crude production in the Persian Gulf area will make a new system to the Mediterranean economically sound. Crude output is growing at the rate of about 7% per year and is now averaging over 4,400,000 bbl. daily.



Demand Is Climbing Again in Europe

- **Incomplete reports point to a 14.8% increase last year over 1957. This compares favorably with pre-Suez period.**

WORD IS not in from all the precincts, as they say on election night, but it appears that Europe has started another demand surge that may take some of the woe out of the world's oversupply problem.

In the years from 1950 to 1956 European consumption doubled. Sales of products increased a phenomenal 900,000 bbl. daily. That wasn't counting oil used as refinery fuel or sold as bunkers. The free world's second-best market was using 1,745,000 bbl. daily, with no end to expansion in sight.

Then the roof fell in. Demand rose only 1% in 1957, the year that Europe tried to pull itself together after the Suez crisis disrupted oil supplies.

The $64,000 question since then has been whether European consumption would ever regain its old momentum. A new report compiled by the Organization for European Economic Cooperation shows just how impressive the gains in the 1950's were until supplies were cut off. Close attention is being paid to see how figures coming in from last year stack up against the period of boom—, and they fit like hand in glove.

'58 looks good . . . In the prosperous early 1950's, demand in OEEC countries, which includes nearly every nation except Spain and Finland, rose with a varying gain of 9% to 16% per year.

Preliminary figures in from countries which use the lion's share of Europe's oil indicate a rise last year of 14.8%. United Kingdom, the biggest consumer, averaged 578,000 bbl. daily, up 15.4%. West Germany drew nearer to France as the second largest market with 353,000 bbl. daily, up 22.2%. French demand showed the lowest percentage increase. But sales of 385,000 bbl. daily still were 8.2% greater than a year earlier.

This rate of growth is quickly putting Europe back on the track forecast by OEEC before the Middle East crisis. The OEEC's oil committee estimated inland consumption would reach 2,740,000 bbl. daily in 1960. Another OEEC group called demand of 6,200,000 bbl. daily by 1975 a conservative guess. Oil companies expect this level will be reached much sooner.

Fuel oil stars . . . In 1956, fuel-oil sales passed the 600,000 bbl. daily level with a 23% increase. In 1958, European Economic Community countries increased fuel-oil use by 19% to nearly 500,000 bbl. daily. This does not include supplies used by some of Europe's biggest fuel-oil users, such as England and Sweden, which are not in the EEC.

The EEC members, France, West Germany, Italy, Netherlands, Belgium, and Luxembourg, had an increased demand of 12.6% for gas-diesel oil. The weak sister product in Europe, gasoline, gained 10.7%.

1958 EUROPEAN DEMAND
(Thousands of barrels daily)

Country	Est. Consumption	% Increase
France	385.0	8.2
West Germany	353.0	22.2
Italy	273.0	15.1
Netherlands	126.0	13.6
Belgium	112.0	14.5
Luxembourg	4.0	14.1
Total—European Economic Community	1,253.0	14.5
United Kingdom	578.0	15.4
TOTAL	**1,831.0**	**14.8**

Runs to stills in European refineries nearly tripled from 1950 to 1957, rising from 822,000 bbl. daily to 2,242,000 bbl. daily. The difference in runs and internal consumption is accounted for by losses, refinery fuel, and the local import-export trade in products.

LPG produced at local refineries has started making headway in local markets. Consumption rose nearly sixfold from 1950 to 1957 from 7,000 bbl. to 40,000 bbl. daily.

Italians Start Work

on one of Europe's largest petrochemical complexes.

WORK has started on a $95-million petrochemical complex to be built at Brindisi, Italy, by Montecatini.

The plant will produce 700,000 tons of chemicals per year, making it the largest in Italy and one of the biggest in Europe.

Several plastics will be manufactured, including polyethylene and Moplen, Montecatini's trademark name for isotactic polypropylene. Polymers for synthetic fibers, aldehydes, alcohols, and organic solvents also will be produced. At least 1,300,000 tons of raw materials will be used annually.

Dr. Piero Guistiniani, managing director, said the new plant will be a large-scale application of new concepts of stereospecific catalysis. These, he said, were discovered by the Italian scientist, Prof. Giulio Natta, and developed by Montecatini.

A 1,200-acre plant site is located near the town of Brindisi, an Adriatic port on the heel of the Italian boot. Montecatini has three other petrochemical plants in operation in Italy, at Ferrara, Novara, and Terni.

Papua Search Is Spurred

THE COMPANIES which brought in a discovery in Papua last year plan to spend $6.7 million in the next 16 months to take a closer look at prospects in the area.

British Petroleum, Standard-Vacuum, and a local firm, Oil Search, have already started the first of two deviated wells on Puri structure. Directional equipment for the test was flown in from the U.S. Puri 1 came in at 1,000 bbl. daily last November but quickly went to water.

The program will also include further geological and geophysical surveys in the same area of Australian New Guinea.

A wildcat will be drilled at Bwata structure, 15 miles northwest of Puri.

EXPLAINING the control panel of Aramco's new plant to Sayyid 'Abd Allah al-Hamud al-Tariki, center, director general of Petroleum and Mineral Affairs for Saudi Arabia, is plant foreman I. E. Richardson, left. F. E. Abbott, Aramco's Abqaiq district manager, is at right.

More Saudi Arabian Gas Saved

. . . with operation of a new gas-injection plant built by Aramco. Company also boosted capacity of second plant.

GAS CONSERVATION has taken a big step forward in Saudi Arabia with completion of a $30-million gas-injection plant in the 'Ain Dar area of Ghawar field.

The plant has a compression and reinjection capacity of 210 million cubic feet daily. Its completion, together with expansion of an older plant at Abqaiq field, means conservation or industrial use of 66% of the gas produced in Saudi Arabia.

Arabian American Oil Co. built the plant 30 miles west of Abqaiq. Gas is gathered from five gas-oil separator plants. Intake pressure of 125 psi. is stepped up in five stages to a discharge pressure of 2,100 psi. Five injection wells are on the crests of two structural closures in the 'Ain Dar area of Ghawar.

Heart of the plant are five 8,500-hp. combustion gas turbine compressor drivers. Supporting facilities include a 5,600 kw. power plant, 34 miles of gas gathering lines, 19.6 miles of injection lines, and a 66,000-volt power transmission line from Abqaiq to 'Ain Dar.

The plant was designed by a team of Aramco and Brown & Root, Inc., engineers in collaboration with Cia. Techniche Industrie Petroli, an engineering contractor in Rome. Offplot facilities were designed by Aramco Overseas Co. engineers in The Hague, Netherlands. All procurement was by Aramco and Aramco Overseas. Construction was handled by Aramco, International Bechtel, and Saudi Arab contractors.

Bolivian Jungles Mapped

AN EXTENSIVE aerial photo-airborne magnetometer survey of 70,000 sq. miles of Bolivian jungles and swamps is scheduled for completion in March.

The mapping operations, carried on for 7 months, is a joint effort of four contractors for a combine of five oil companies. It will cost approximately $700,000. Flight schedules were hampered by restricted curfew periods, bad weather, and a threatened revolution.

Five oil companies granted exploration concessions by the Bolivian Government included Royal-Dutch Shell, Gulf Oil Corp., White Eagle International Oil Co., Standard Oil Co. of California, and Tennessee Gas Transmission Co.

Pemex Banks on American Aid

. . . in Mexico's oil-development program. U. S. firms have roles in gas-line project, proposed petrochem complex.

PETROLEOS MEXICANOS expects to lean heavily on American know-how in constructing a new 500-mile natural-gas line. Pemex's new president, Pascual Gutierrez Roldan, said in Houston last week.

Gutierrez Roldan also disclosed that Mexico is interested in joining the race for a slice of a potentially great liquid-methane market, which is now being tested by a U.S. company.

The projected new pipeline, which will connect Mexico City with a gas-producing area at Ciudad Pemex, will be financed by $40 million in American capital (OGJ, Mar. 9, p. 104).

Negotiations are under way with Houston's Fish International to join three Mexican firms in building the $43-million, 24-in. line. Fish International confirmed Gutierrez Roldan's announcement.

The Mexican official said Fish would represent U.S. banks which are putting up $40 million of the pipeline costs and assist in procuring equipment and lending technical advice.

Plants projected . . . Another U.S. company also will figure in Mexico's oil-industry development.

Gutierrez Roldan said an American firm, yet unnamed, will do the engineering on a petrochemical complex now in the planning stage. French capital is expected to finance it.

There is plenty of room for private development of the petrochemical industry in Mexico, according to Gutierrez Roldan, but Pemex will step into the picture any time it sees an opportunity for itself.

He said discussions have been held with Phillips Petroleum Co. in regard to a synthetic-rubber plant, and other companies have been contacted in regard to petrochemical and refinery operations.

In California last week, J. S. Fluor, president of Fluor Corp., Ltd., said his company has been awarded a $50-million contract by Pemex. The agreement calls for construction of three 200-ton-per-day ammonia plants and a Platformer-Udex unit.

Pemex will remain the sole company to explore for oil, but there is opportunity for U.S. drilling contractors to make drilling deals in a stepped-up exploration and development program for 1959.

At present there are three U.S. drilling contractors operating under contract to Pemex.

Methane exports? . . . Gutierrez Roldan was asked whether Mexico will allow greater export of natural gas. He did not reply directly but said Pemex is interested in the possibility of exporting liquid methane in ships.

Constock International Methane, Ltd., recently sent its ship, "Methane Pioneer," from Louisiana to England in the first test of a program to furnish natural gas fuel by ship to Europe (OGJ, Mar. 9, p. 82).

New Plants Planned

by Koppers in Argentina. Facilities will be built near Buenos Aires.

NEARLY $25 million will be spent in Argentina on new facilities to make basic materials for plastics and synthetic-rubber requirements.

Industrias Plasticas Argentinas Koppers, S.A. (IPAK) will build the plants near Buenos Aires. IPAK is an organization formed by Koppers International, a subsidiary of Koppers Co., Inc., and private Argentine interests.

New facilities will include an ethylene plant, a polyethylene plant, and a styrene monomer plant. They are expected to be on stream by 1961.

The ethylene plant will be the first in Argentina to use refinery gases as feed stock. The polyethylene unit will have an initial capacity of 15 million pounds per year and can be readily expanded. Annual capacity of the styrene monomer plant will be 15,000 metric tons (33 million pounds).

Import savings . . . The styrene plant initially will supply monomer to polystyrene plastic manufacturers now operating on imported monomer. Reductions in these imports will make possible savings to Argentina in foreign exchange.

The plant will have sufficient capacity to supply styrene monomer for anticipated manufacture of synthetic rubber in Argentina.

The ethylene and polyethylene facilities will cost $16 million to $17 million and the styrene monomer plant approximately $7.5 million. An $8 million credit has been granted IPAK by the Export-Import Bank.

Feed stocks will be supplied under contract from refinery operations of Yacimientos Petroliferos Fiscales (YPF), the Argentine government oil agency. Although not specifically stated, the feed gas presumably will come from the 95,000-bbl. YPF refinery at La Plata, near Buenos Aires.

Brazil Makes Deal

to buy Venezuelan oil, sell its own waxy crude to Esso.

PETROBRAS and Esso Export Corp. have reached a two-way crude-sales agreement covering 28,000,000 bbl. of Brazilian and 80,000,000 bbl. of Venezuelan oil.

The Brazilian government company will sell Esso Export about 28,000,000 bbl. of oil from Bahia fields over a period of about 3 years. The international marketing affiliate of Jersey Standard plans to ship most of the crude to the Netherlands West Indies, where Aruba refinery can handle the unusual heavy wax content of the oil.

Shipments will average 25,000 bbl. daily if the full 28,000,000 bbl. are delivered over the life of the contract. Esso declined to cite a per barrel cost of the crude because of variables and for competitive reasons. But it did confirm a Rio de Janeiro report that it might pay as much as $85 million for the Bahia oil.

The other side of the agreement calls for purchase from Esso of 80,000,000 bbl. of Venezuelan crude, which can be handled in existing Petrobras refineries. The imports will be made over a 6-year period, with shipments averaging 36,500 bbl. daily.

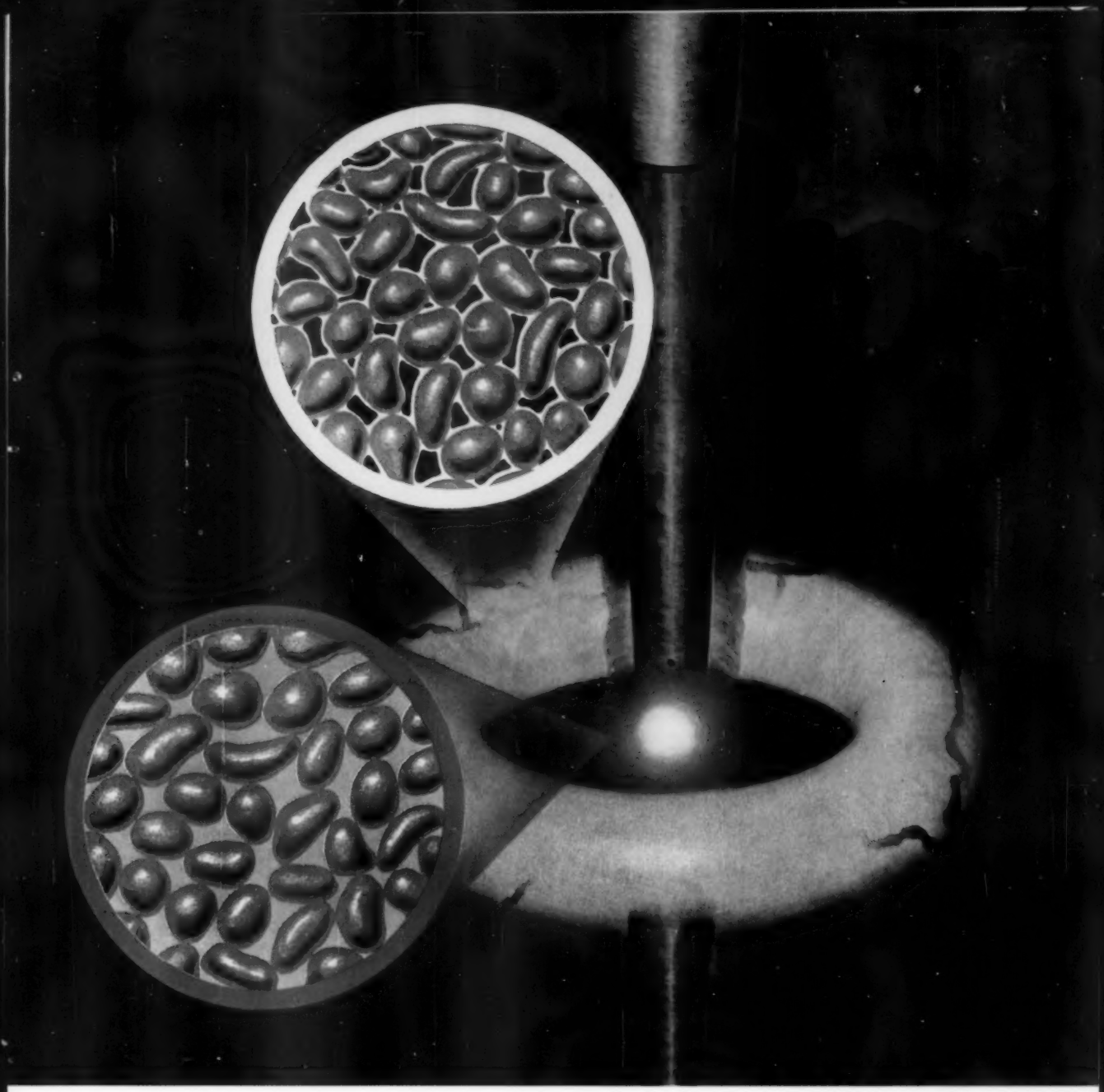
Cay Sal Test Goes Deeper

AN OFFSHORE wildcat in the Bahamas is getting into the class of world's deepest holes as it nears its first birthday.

The Cay Sal 4-1 has a long way to go to be the deepest hole. But it is drilling ahead at 18,466 ft., which puts it in the class where deeper wells are few and far between.

Gulf Oil Corp. and Standard Oil Co. of California budgeted $3 million to get the wildcat started last March 23. The well is located about midway between southern Florida and northern Cuba and lies 187 miles southwest of Nassau.

Original projected depth was 15,000 ft., but drilling has kept right on going. The hole is tight, with no information available on what has been found. Casing of 13⅜-in. pipe was set to 4,000 ft., and 7-in. has been set to 15,131 ft. A 6¼-in. bit is now being used.



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AGAIN FIRST IN THE FIELD—FOREMOST IN RESEARCH

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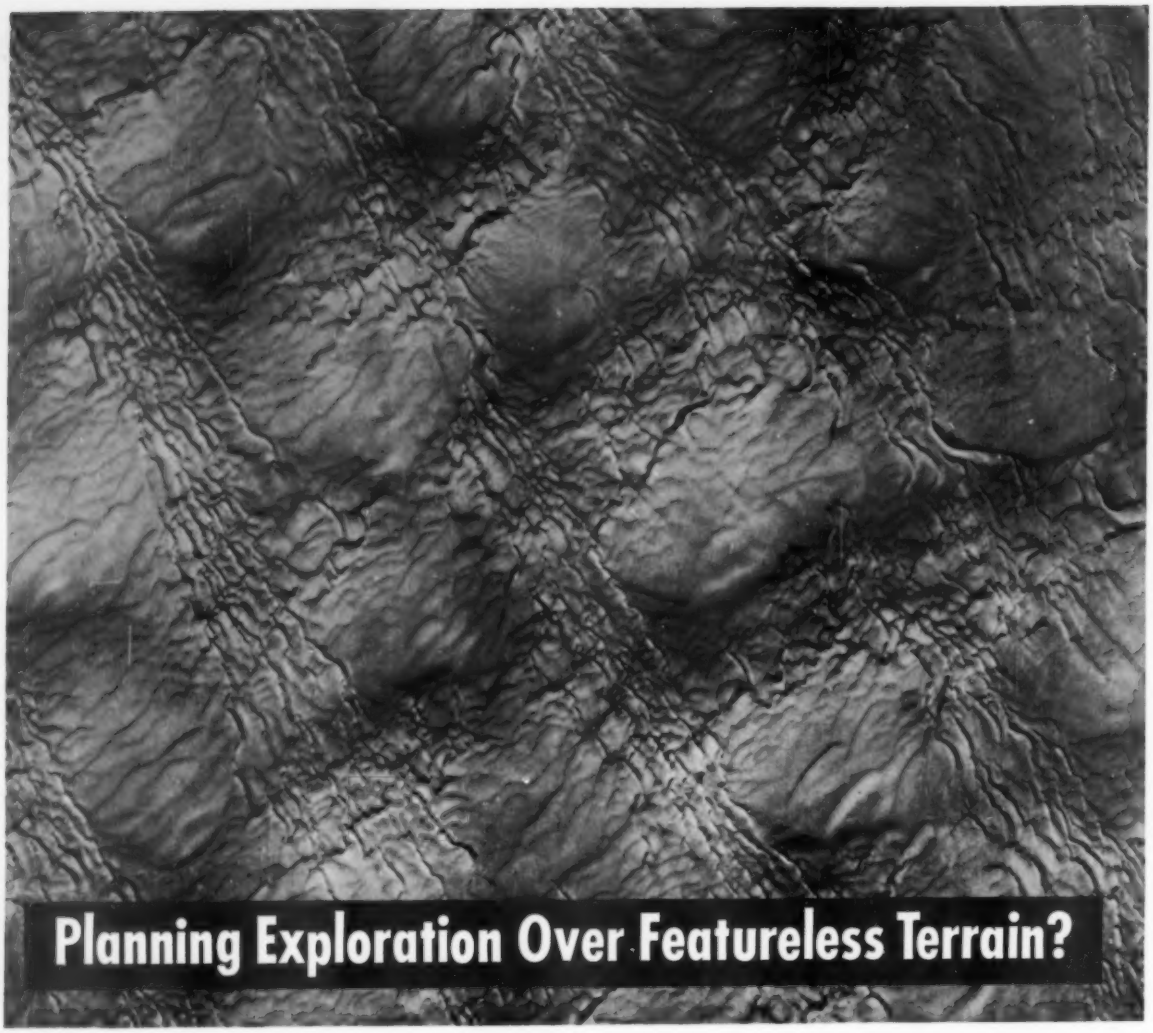

Planning Exploration Over Featureless Terrain?

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ALASKA

A SPECIAL SECTION

Oil men today agree that no other state in the union offers as much magnetic appeal to the oil hunter as does ALASKA. The possible oil provinces outlined on this map provide a starting point for exploration in force.

This annual exploration issue of The Oil and Gas Journal devotes itself to a searching look at this newest oil state—to an appraisal of its chances, its attractions, and its problems as a habitat of oil.

THE COASTLINE OF KENAI PENINSULA displays in outcrop one of the targets for exploration in Alaska. These nonmarine Tertiary sediments form potential oil reservoirs in other parts of the state. Eight interbedded coal seams and an abandoned mine add economic interest to the picture.

THERE'S OIL IN ALASKA . . .

About the author . . .

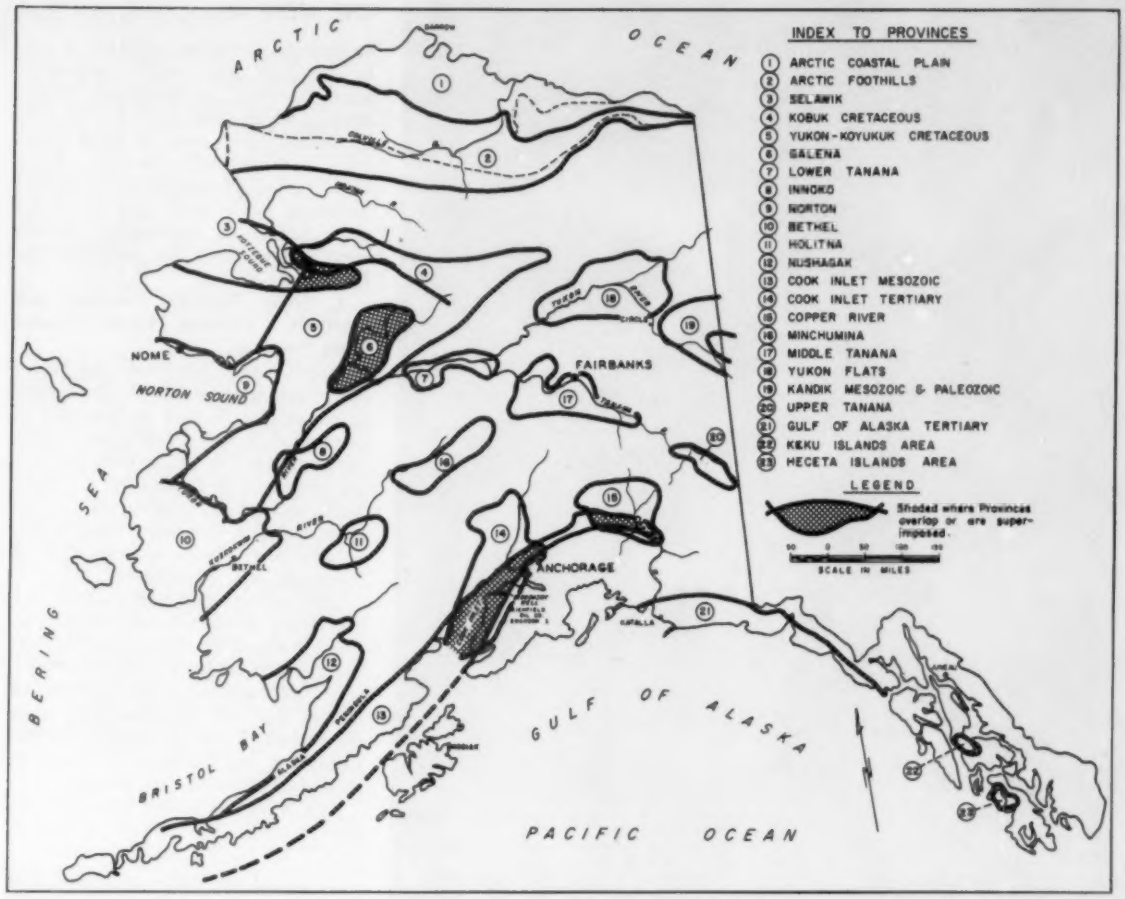
Max Birkhauser, seen here at the left, was born in Basel, Switzerland. He mapped extensively in the French part of the Jura Mountains and completed his studies with Ph.D. degree in 1924 from University of Basel. He joined Shell Oil Co. at Bakersfield, Calif., in 1925, as a field geologist, worked in California, Canada, Rocky Mountain States, and the Pacific Northwest. He spent seven summer seasons in Alaska and is now located in Shell's headquarters at Los Angeles.

But it will take lots of men, money, and patience to find it. A veteran explorer of Alaska draws on his experiences to draw a profile of the forty-ninth state . . . its challenge, its problems, and its chances for oil. Explorationists must exert a lot of effort and study to make Alaska reward the oil hunter. The author's advice: "Start digging now."

BY MAX BIRKHAUSER
Shell Oil Co.

MUCH has been written, much has been said of Alaska—its vastness, its tremendous variety of geology and geography, its extremes of weather, its natives, and its promise of becoming one of the world's great storehouses of oil. With the nation celebrating its centennial of oil, Alaska is merely on the threshold of a great new era. Our forty-ninth state offers oil hunters their greatest challenge yet. Oil finding in Alaska won't be easy, nor will it be cheap. Development will be slow with nature the greatest obstacle.

The rush begins . . . Oil exploration in Alaska is not new. For many years geologists have probed through the geologic complex from the Bering Sea to the southeastern shoreline. But in 1957 Richfield Oil Corp. began Alaska's oil story with the big find on the Kenai Peninsula. A second discovery, new-pay production, in the same field in 1958 added more fuel to the growing fire of oil interest. But these discoveries, important as they are, were almost overshadowed by the migration of oil men, geologists, scouts, land men, lease brokers, and suppliers



THIS PRELIMINARY MAP of Alaska's possible petroleum provinces was published by the USGS in 1957. It is used as a guide throughout this discussion.

to Alaska. This vast influx of oil hunters indicate the potential that the industry believes this new state contains.

Times change fast . . . Discovery of oil at Kenai and statehood for Alaska give impetus to exploration in the Far North country which is in its infancy. Everything points to Alaska becoming an important oil province. But, besides nature and its impact on both terrain and living things, many great problems lie ahead for the oil seekers.

There are 586,000 sq. miles of land waiting for the explorers. Only 162,000 people live here, but this number is increasing at a fast clip.

A QUARTER-CENTURY AGO, these wells produced oil at Katalla field in the Gulf of Alaska Tertiary province. They were abandoned in 1933.

JOHNSTON CREEK in the Gulf of Alaska Tertiary province. Mount McPherson, with an elevation of 6,467 ft., is the highest peak on the north flank of the Sullivan structure. Rocks exposed above the timber line belong to the Yakataga formation (Miocene-Pliocene).

The advent of oil will make cities like Fairbanks and Anchorage grow into major centers of commerce and industry. Anchorage is already the "oil capitol of Alaska." Native Alaskans will be feeling oil's impact. The State University of Alaska will no doubt be contributing geologists in the next few years to the steady stream of explorationists already pouring into the new state. Oil revenue will bring with it many new aspects: industry, people, legislation, and problems.

Explorers move with care . . . The events at Kenai will cause a greatly accelerated exploratory and development program this year. No one yet knows how far this program will go this year, but 1959 may be Alaska's birth into the wildcatting family of states. Companies moving into Alaskan work will learn and gain abundantly.

Much has already been learned of the state's geology, and a great deal more remains to be known. The explorer is aware of Alaska's transportation and supply problems. The task before the geologist and driller seems almost impossible, but we will see in a few short years perhaps oil's most exciting chapter yet written in the Land of the Midnight Sun. The problems of transportation, communication, and supply are seemingly unsurmountable. These tasks must be worked out in detail long before the push into the back country begins.

Areas of interest . . . The map, "Possible Petroleum Provinces of Alaska," published by the USGS in 1957, will be used as a guide in the following discussion. It should be pointed out, however, that this map is a preliminary edition which has not been edited or reviewed for conformity with the USGS standards and nomenclature. Not all of the provinces outlined on this map will be discussed, partly because some of these areas were not investigated, and partly because here the definition of a basin will be restricted to a region in which it can be assumed that marine sediments were deposited in maximum thicknesses. To all appearance the chances of finding oil in some of these provinces look decidedly meager. Additional geological and geophysical work, including many strat tests, must be done before an exploration department can evaluate the areas suitable for wildcat drilling.

1. Arctic Foothills Province and Northerly Adjacent Arctic Coastal Plain Province.

Within these provinces lies Naval Petroleum Reserve No. 4. Its history of exploration is well documented in Geological Survey Professional Paper 301, published in 1958. Well histories are presented in Papers 305A, 305B, 305C, and 305D. In addition, 132 reports on Naval Petroleum Reserve No. 4 have been placed in open files at Fairbanks and Washington.

Let's assume that you wish to buy everything published on the reserve. The bill would be slightly over $1,300 —for which investment you would receive information worth millions of dollars, but only for those who have the technical staff to analyze the information, and the capital to invest in further exploration and drilling.

The Navy has drilled 45 core holes and 36 wells. The deepest of these is 11,872 ft. Navy drills discovered:

1. Umiat oil field—estimated 200 million barrels plus.

2. Gubik gas field—estimated 22-295 billion cubic feet of gas.

3. Simpson oil field—estimated 12 million barrels.

4. Barrow gas field—estimated 5-7 million cubic feet of gas.

Much valuable information also can be obtained from Oil and Gas Investigations Map OM 126. Sheet No. 1 shows a geologic map of Naval Petroleum Reserve No. 4 and adjacent areas. Next to the map is a generalized columnar section of post-Devonian rocks of the Arctic Slope and two sections indicating facies changes in the Nanashuk and Colville group, both of Upper Cretaceous age.

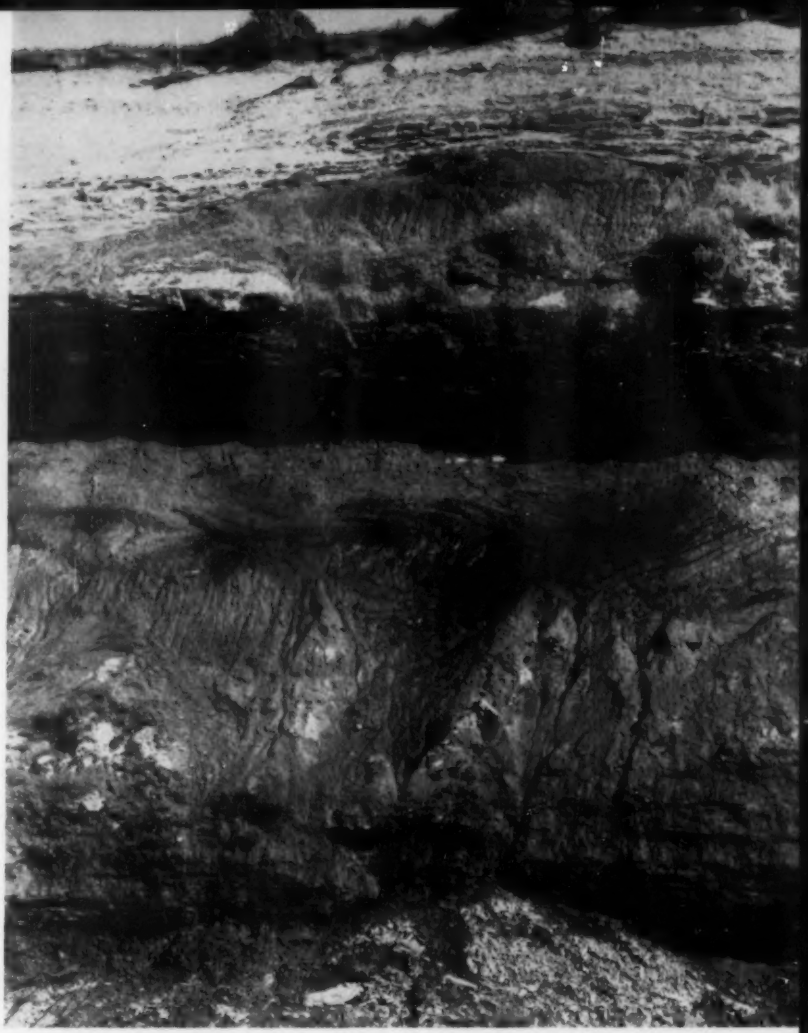
The cross-section drawn through the South Barrow test wells portrays a picture which must have come as a surprise to structural geologists. Prior to drilling the Barrow wells it could be conjectured that the Barrow area would lie in a fairly deep portion of the Cretaceous basin. This theory was proved wrong when South Barrow test well No. 2 hit basement rocks at 2,505 ft. It drilled into an ancient ridge now known as Barrow "high." This Barrow high is also clearly expressed on the gravity map and the seismic

map as illustrated on Sheet No. 2 of Map OM 126. It seems now reasonable to speculate upon the possibility that the well-known large oil seepages, which occur between Dease Inlet and Smith Bay, might suggest that some oil was trapped along the fringe of this structural high.

Subsurface indications from the Navy wells indicate that the deepest portion of the Cretaceous basin would fall some 17 miles south of Umiat oil field.

It can be concluded that in the area north of the Brooks Range, oil could occur in Cretaceous beds along anticlinal folds and downdip from the Barrow high in Cretaceous or older sediments. It also could occur in the Lisburne limestone which is of Mississippian age, and in the Devonian which proved to be so prolific across the border in Canada.

Today leases for oil exploration are not obtainable within the Naval Reserve No. 4. Last year the Government offered some leases in the area adjacent to the reserve and the interest shown in these lands was rather remarkable. Some students of the Naval Reserve problem are advocating that it should be returned to the new state. Geologists and engineers should be prepared for such an event and start digging now into the voluminous amount of geologic and logistic informations published by the Government.



THE KENAI FORMATION (Tertiary) outcrops along the coast of Kenai Peninsula, ½ mile north of Ninilchik. Seismologists will note that a rather thin section of glacial drift covers the coal-bearing Kenai.

2. Gulf of Alaska Tertiary Province.

This province extends along the east shore of the Gulf of Alaska from the delta of the Copper River to Icy Point. In the westerly portion of this region lies now-abandoned Katalla oil field, which during its lifetime, 1903-1933, produced 154,000 bbl. of oil from 22 wells. Wells ranged in depths from 360 to 1,750 ft. The wells are located in a topographic depression in which at least 10 to 12 oil and gas seepages were noticed, supporting the idea that the oil might have accumulated in a fractured fault zone. A geologic map of the Katalla district by Don J. Miller, et al. was published by the USGS in 1951.

Perhaps of more interest may be the Yakataga district which follows the coast line from Cape Yakataga to Icy Bay. The area of greatest promise perhaps could be the Sullivan anticline outlined on Don J. Miller's map "Geology of the Southeastern Part of the Robinson Mountains," published by USGS in 1955.

Phillips Petroleum Co. drilled two deep wells (10,013 and 12,054 ft. respectively) in Little River, 7 miles northwesterly from Icy Cape, but neither scored a commercial discovery.

Geological mapping is extremely difficult in the Yakataga district because Sullivan anticline is a complicated structure and good outcrops, where needed most, are rather small and restricted to creek banks.

A possible easterly extension of the Sullivan anticline would fall under the Malaspina glacier. Drilling on an ice field which is in motion might be too hazardous with present equipment. The Geologic Map of the Malaspina District, by Don J. Miller, published by USGS in 1954 shows an oil lake near the south rim of the Samovar Hills, located north of the Malaspina glacier and an oil seepage in Eocene rocks near the center of these hills. This seep is the most easterly showing of oil in the State of Alaska and its discovery some years ago was even mentioned in the Wall Street Journal. Important is the fact that it occurs in marine Eocene strata which so far were considered coal bearing and of continental origin only.

A large plain, covered by Quaternary deposits, extends eastward from the town of Kakutat to Icy Point. The northerly border of this plain, some 15 miles north of Yakutat, is sharply defined by topography, the result of a thrust fault along which older formations where pushed upon the Quaternary. These older formations known as Yakutat group of Mesozoic age consist of graywacke, argillite, and slate and offer little encouragement to the oil man. The well now drilling near Yakutat certainly must be seeking more promising objectives; most likely it is exploring for source and reservoir beds within a Tertiary series. Colorado-Frankfort Oil and Continental companies are now drilling below 10,000 ft. in the second whipstocked hole of the third well in this area. It is reported that some favorable appearing section has been encountered.

3. Cook Inlet Mesozoic Province and Cook Inlet Tertiary Province.

The government map shows an overlap of these provinces on the Kenai

AFTER THE SUN MELTS THE ICE from the glaciers, the river beds are filled with "glacial milk." Here, a Shell field party crosses Johnston Creek. Records show that many geologists and surveyors have drowned in such icy waters as these.

Peninsula indicating that either Mesozoic or Tertiary formation or both might be productive in this area. Center of attention continues to be the Kenai Peninsula, scene of Richifeld's discovery September 30, 1957. Standard is acting as operator for itself and Richfield and plans to spend some $30,000,000 on development and exploration during the following years.

Geographically the province can be divided as follows:

1. Alaska Peninsula.

2. Anchorage basin, including Kenai Peninsula and the Susitna drainage area.

3. Matanuska Valley.

Alaska Peninsula is well known to oil operators. First drilling was done in 1898-1906 on the Iniskin Peninsula and major oil companies entered the Kanatak region in 1926. The wells drilled there started in Jurassic sediments and never reached older formations. Only 1 year ago oil sands were discovered in outcropping Cretaceous beds in the Chignik region. Commercial production should occur somewhere on this large area but has not been discovered as yet.

Anchorage basin. Activities will show a steady increase on the Kenai Peninsula where to date production is restricted to Richfield's Swanson River Unit. Standard's Deep Creek Unit No. 1, east of Ninilchik, was abandoned at 14,221 ft. The well was apparently located largely on surface evidence though seismic exploration had been attempted in its vicinity. Seismic information if it can be obtained is important in this region because outcrops in the Kenai formation are scarce and insufficient to determine surface structures.

The Susitna drainage area has outcrops only along its borders. Subsurface information must be based on wells drilled near Houston and at Goose Bay. All these wells failed to find oil, but established a rather thick section of nonmarine Eocene beds from which it could be concluded that at least a portion of the Susitna River area could be called a structural extension of the Kenai Peninsula and such will see considerable activities in 1959.

Matanuska Valley, the beauty spot of Alaska, offers the structural geologist a great number of difficult problems most of which, however, may have only a scientific value. Formations might be comparable in age with the Kenai formation but instead of finding fairly gently dipping beds in easily drillable strata, the formations in Matanuska Valley are hard, steeply dipping to vertical and overturned. Faults are common; displacement can be small as found in the coal mines and can reach several thousand feet along major thrust zones in the outcrop.

As a matter of fact the Tertiary in Matanuska Valley does not even look like the Kenai formation and may be even older, a controversy which will have to be settled by the botanists in due time. In this broken-up country nowhere do we find a leakage of oil or gas.

4. Copper River basin.

This high intermontane valley, practically covered by leases at the present time, shows nothing but Quaternary deposits on the surface. Only seismic work, core drilling, and wildcatting can evaluate the possibilities of this basin. In the Nelchina area a thick section of Mesozoic marine shales, sands and limestones are exposed which series presumably could extend into the valley and some geologists even speculate on the possibility of finding Tertiary sediments within the basin although there is no evidence that it may be so. The geologic map of Alaska shows volcanic rocks along the north and east border of the valley and if these rocks should continue into the basin the chances of finding oil here would be not very good. Copper River basin should be kept in mind as a possible, but highly speculative, hunting ground for oil.

5. Bethel basin.

In this land of a thousand lakes and no outcrops are some 6 million acres leased by oil companies. All we know is that during the winter months any kind of survey work might be conducted more successfully than in dreary, rain-soaked and windswept summertime. The climate as we learned from experience seems to have a rather depressing influence on the field men. The geologist has to start from scratch!

An aeromagnetic survey conducted some years ago by the Government indicates some kind of a structural deep roughly coinciding with the present drainage of Kuskokwim River. A careful survey of the west border of the Kilbuck Mountain (east border of Bethel basin) may give us a chance to theorize intelligently regarding conditions which might exist within the basin; also some help could be expected from a study of the Yukon

River section though there are unsolved problems (age of formation) along the banks of the river at Marshall.

Bethel basin covers such an enormous area that we must consider it, or at least a portion of it, as a possible petroleum province; its geologic history is unknown. Someday, however, it might be visualized, assuming of course, that much pertinent information can be obtained from wisely executed exploration, that in this vast region areas of promise will be disclosed. Possibly three or four major companies could pool their talents for working out the best possible attack in this remote and difficult province.

6. Kandik Mesozoic and Paleozoic Province.

The portion of this province which is covered by "Mz" = Cretaceous, Jurassic, and Triassic rocks undifferentiated is considered well worth serious consideration. The fact that the geologist who mapped here pooled all these formations under Mz does not exclude the possibility that more detailed mapping might permit a division into several members and a better understanding of surface structural features.

Much new information can be obtained by traversing Yukon, Kandik, and Nation rivers where good outcrops assure plenty of new data. The area must look attractive because in the vicinity of Nation, an abandoned village, occur richly saturated oil shales and farther up the Yukon River, Permian-Carbonifeous limestones rich in fossils and all these formations could be called objectives in the Kandik Mesozoic province.

Field work may start toward the end of May and should be terminated in September because very low temperature might prevail later in the year.

7. Yukon — Kuyukuk Cretaceous Province.

The latest published report on this area are listed below for the specific reason that the oil men interested in the oil possibilities of this territory should study these papers and decide for himself how much promise this province may hold.

Nearly all the geologic maps are based on aerial photographs, most likely because mapping on the ground is very time consuming and expensive and the field season might be too short to accomplish much work in one season. An analysis of cross-sections thru the Shaktolik River area, particularly line A-A', Item 2 below, clearly indicates that with the data at hand a satisfactory picture cannot be constructed and credit should be given to the author of this section for having the courage to indicate just how little is known about this area. In this highly folded belt of Cretaceous sediments, which was broken up by a least two different periods of faulting, the search for oil will be extremely difficult.

AN ABANDONED COAL MINE sits on the shore of Kenai Peninsula. These flat-dipping formations, Tertiary in age, are 1 mile north of Ninilchik.

List of recently published reports:

1954—Areal Geology and Structural Interpretation Map Katell River Area, Alaska; Geophoto Service, March 1954.

1956—Geologic Map and Structure Sections of the Shaktolik River area, Alaska, by William W. Palton, Jr., and Robert S. Bickel; USGS Misc. Geol. Inv. Map 1-226 1956.

Geologic Map and Structure Sections Along Part of the Lower Yukon River, Alaska, by William W. Palton, Jr. and Robert S. Bickel; USGS Misc. Geol. Inv. Map 1-197 1956.

1957—Reconnaissance Geologic Map of the Kateel River Quad. Alaska by John T. Cass; USGS Misc. Geol. Inv. Map 1-243 1957.

And Now?

Events to date indicate that Alaska will be an important oil-producing state. But Alaskan exploration must be based on a long-range program. Money invested now may not bring results for many years to come. In 1952 the writer completed his field season in Alaska. Much had to be learned about the geology and much more about transportation and the ever-changing climate.

A native of Anchorage who spent all of his life in the North expressed his idea about seasons in Alaska as follows: "Here in Alaska, we have two seasons . . . the Fourth of July and winter." This apparently poorly expressed sentiment, however, should be taken seriously by oil men, because no matter how good the climate might turn out to be, exploration work under even the best conditions will be very expensive . . . let's say is will cost 4 to 10 times as much as in California.

It seems, therefore, important to begin drilling at the beginning of the most favorable season. Such a time can be fairly accurately selected after consulting government charts on tides, temperature, snow, and rainfall . . . but most of all beware the wind. This is Alaska's biggest problem, surmounting even the mosquitoes.

Exploration managers may not be particularly interested in the age of his employes in most areas of the world, but experience indicates that youth should be a second consideration in Alaska; what will be needed are older men who have learned to deprive themselves of conveniences. But one fact remains . . . there is oil in Alaska, but it will take lots of men, money, and patience to tap it.

GROUND MOBILITY is often hazardous. Bulldozer tows trailer camp (above) and shooting truck winches over a tight spot on trail (left).

"Just getting there"

is Alaska's No. 1 problem

At least it's the biggest headache troubling companies engaged in geophysical operations

BY E. A. KIESLER
Alaskan Supervisor,
Geophysical Service, Inc.

IN AN AREA where the usual cost of transportation is sometimes threefold, and runs the gamut from dog sled to multiengined aircraft, things can look pretty grim when the wind is blowing 100 m.p.h., the temperature stands at 40 below, and there is only enough light each day for about 4 hours' normal work.

However, once a geophysical operation gets its feet firmly planted on Alaska's glacial till, it compares rather closely with work in Canada during certain seasons of the year and, to a lesser degree, with winter operations in a few of our older northwestern United States.

All of Texas isn't like the Panhandle and all of Alaska isn't like a refrigerator. The warm Japanese current keeps coastal temperatures at a summer average of about 60° F. and the mercury rarely drops below zero in the winter. Interior temperatures get down to 70° below and soar as high as 100° during the summer. However, most exploration men will experience quite a bit of chilly weather, since many of the areas of interest are very difficult to traverse except during the ground-frozen winter.

Earlier exploration . . . Our friends across the pole, the Russians, were probably the first to realize Alaska's great petroleum possibilities, having reported seeps as early as 1853, just a bit over 100 years after our now-new state was discovered by Vitus Bering.

A number of oil companies have tried their luck in Alaska since about 1900; however, the most extensive and difficult exploration work in Alaska, or in any Arctic area for that matter,

TRAILER CAMPS, wheel or truck-mounted, make ideal quarters for Alaskan operations.

was performed by the U. S. Navy on its Naval Petroleum Reserve No. 4 and adjacent areas from 1944 to 1953.

Of the eight or nine areas which are considered to be possible petroleum provinces in Alaska today, the NPR-4, north of the Brooks Range, is by far the most remote and inaccessible.

Although the exploration work by the Navy and its contractors did result in discovery of one medium-sized and one small oil field and two gas fields of fair size, these discoveries were made at what would appear to be a tremendous cost. However, it must be remembered that the Navy's 9-year expedition paid off in much more than oil discoveries alone. In the Navy's History of Exploration, Petroleum Reserve No. 4, by Commander John C. Reed, it is pointed out that "many informed persons feel that the experience and knowledge gained were worth the total investment from the standpoint of defense and Alaskan development, aside from its (the expedition's) primary objective . . . the interpretation of the oil possibilities of NPR-4.

Cost of Navy's work . . . The oil industry, in particular, will benefit from the technical and logistical experience gained by the Navy in the Point Barrow area, but private interests would do well to study the costs involved in the Navy program, keeping in mind, of course, the fact that it was carried out in Alaska's remotest region.

For instance, according to Commander Reed's narrative, the cost of geophysical work alone was nearly 9 million dollars for the 9-year period. The total figure, including drilling of 36 test wells and 44 core holes, geological exploration, camp maintenance and operation, air lift and airway facilities, and miscellaneous supporting expenses, was more than 47½ million dollars. In addition, the value of the installations at Point Barrow and Fairbanks, together with noninstalled rigs, oil-field supplies, construction equipment, and stores totaled nearly 12 million dollars at the termination of the work in 1953. Not included in the exploration budget was the cost of the annual resupply expedition to Point Barrow. When comparing this operation with resupply problems in much more accessible areas, it is evident that a very considerable cost was involved here also.

Factors affecting operations . . . The specter of operating cost cannot be lightly considered in any exploration program. And, in the subzero wastes of the Arctic, equipment failure and impossible working conditions can

RIVER, MUSKEG, and isolated lake-terrain north of Anchorage.

THE AUTHOR

E. A. Kiesler is supervisor of Alaskan and western United States operations of Geophysical Service, Inc., Dallas. He joined GSI in 1936, and for the past 23 years has worked first as a computer on a seismic field party, then as party chief, senior seismologist and supervisor, both in the United States and Canada. Kiesler holds a bachelor of science degree in electrical engineering from University of Texas.

form a combination which deals a heavy blow to production, with a corresponding heavy increase in the unit cost of exploration.

The amount of daylight available during the winter months is a big factor in planning geophysical operations. During some months, even in the more southern areas, there's only 4 or 5 hours of available light. This particularly affects the highly portable helicopter operations, since considerable care must be exercised in hooking up the recording "doghouse" and other items of equipment. Attempts to hook up and operate in partial or total darkness would be extremely hazardous. Truck and track-vehicle operations are less affected, since they can operate somewhat with their headlights. This reduced production considerably increases the cost per seismic profile.

Much of the surface of the sedimentary basins is covered with muskeg, swamps, lakes, and streams, and some heavy stands of timber hinder operations on the Kenai Peninsula. Because of the muskeg and swamp terrain, much of the area cannot be economically worked except during the winter months when the ground is frozen.

This presents the additional problem of snow . . . up to 100 in. during the winter in the Cook Inlet area . . . and the constant companion in Alaska, the wind, can pile it into drifts 15 and 20 ft. deep. Drifts of this sort can be quite interesting to the jug hustler, who must learn to walk again . . . on snowshoes this time.

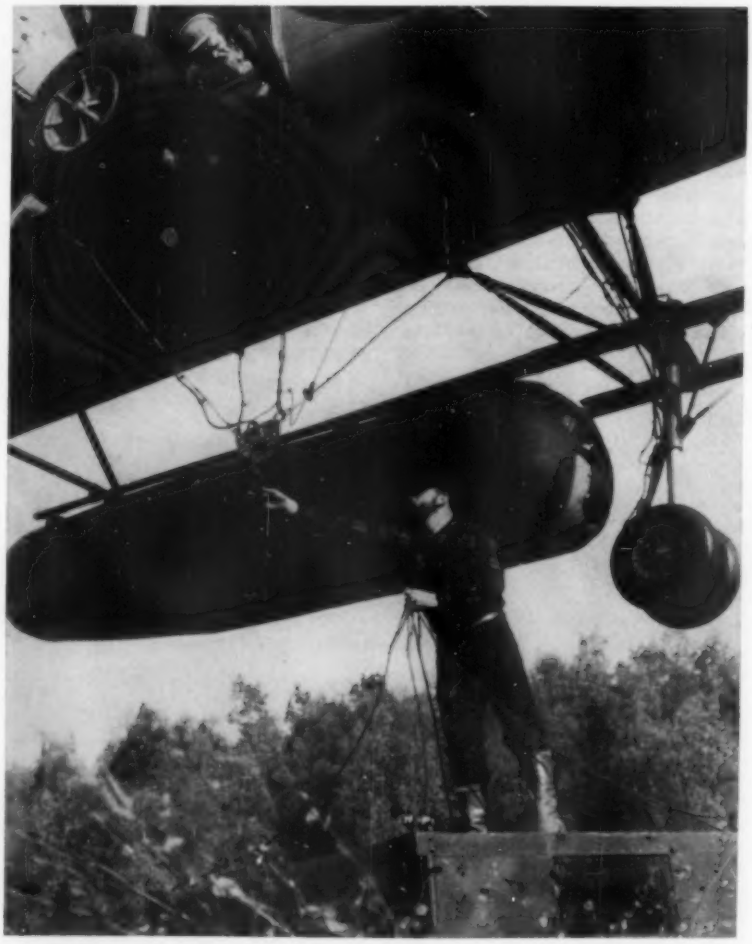
Since "just getting there" is such a problem in Alaskan operations, the helicopter is relied on by many companies as their prime means of operational locomotion. Seismic exploration using helicopters and scattered dip-strike control proceeds considerably faster than any other method, since the 'copters can land in cleared areas (swamps or lakes) a mile or so apart, making it unnecessary to cut lines through the brush. However, if continuous coverage is desired, it is necessary to hand-cut lines and pack equipment. The recently announced transistorized seismic amplifier system, with all 24 channels in a single suitcase-sized, one-man pack, should be quite a boon to operations of this sort in Alaska.

The scattered dip-strike control obtained with helicopter parties should be considered only as reconnaissance for obtaining leads for large structures. These leads are then followed up with continuous coverage using a truck or track crew.

Although helicopters can operate throughout the year, their operations

How a geophysical crew "gets there"

1. **ALL-TRANSISTOR** 24-trace systems greatly simplify portable operations. Complete unit is compact and light.



2. **GOOD EYES** and steady reflexes are essential in hooking up instrument doghouse for 'copter lift to next shot point.

3. **UP AND AWAY** goes doghouse to new location by "chopper." Many areas inaccessible by other means are now surveyed by this method.

4. **AIRBORNE JUG HUSTLER** prepares for ground bailout. Small geophones help portability. "Mush man, mush!"

are limited in winter by the short daylight hours. The helicopter's payload is quite small also, and this tends to boost operating costs when 'copters are used for transporting considerable loads. The maximum payload of the Sikorsky S-58 is about 2,500 lb., and the rental cost per hour is $300 to $350. So, although the helicopters are ideal for some operating tasks, it is advantageous to bring in the bulk of supplies and equipment with other means of transportation.

Trucks can be used in the winter, along trails cleared by bulldozers, and along existing roads (there are a few) for transportation all year long. In a few areas, trucks can be used along trails during the thaw period. However, it would appear that track vehicles of one sort or another are best suited for all-round use in Alaska. The rough conditions of the trails are very hard on wheeled vehicles, and maintenance costs are high; and helicopters have their payload and economic limitations.

Track vehicles can be used during the thaw, if they are operating on trails bulldozed the previous winter. However, even on a track crew, bulldozers are required for clearing new trails, clearing new snow from old trails, and moving camps.

There are two makers of track vehicles in Canada which manufacture vehicles suitable to Alaskan operations. However, the smaller of these does not have sufficient load capacity for transporting a large shot-hole drill.

Drilling, recording techniques... Shot-hole drilling in most basins of Alaska will be quite difficult, due to the glacial boulders and gravels. Minimum size drills on track or truck crews should be of the Mayhew 500 type or equivalent.

Although portable drills can be used, they are good only through the several feet of gravel overlying the large glacial boulders. Shallow-pattern-hole drilling with the portable drills is slow going, and in the winter, the light drills will not penetrate the ice and permafrost. In some cases, sharp blades at the end of heavy steel rods must be used to pick holes through the surface ice, which is up to 2 ft. thick. Deep shot-hole drilling also has its drawbacks, since the holes tend to cave badly before they can be loaded.

The deeper holes and continuous-coverage shooting should give better weathering control, although the variable layer of unconsolidated drift and stream deposits will undoubtedly cause some poor record quality even with the deeper shot holes.

Multiple seismometer arrays will probably be necessary in most areas of

HAND PULLOUTS are common practice. Note the shoulder reel used to carry seismic cable.

Alaska. A noise study procedure should be instrumented to determine the optimum shot-hole depth and seismometer array. Such a study is of particular use in poor record areas.

The variable drift layer in Alaska causes a correction problem in seismic interpretation, particularly if the shot holes are not drilled through the drift. When holes don't penetrate the drift, special recording and computing technique must be applied to account for the variable drift layer.

Some offshore seismic work has been done in the Cook Inlet area. Offshore shooting must be carried on in the winter months, due to regulations which prohibit shooting during the spring and summer fishing season. Here, again, the lack of daylight hampers operations, which are further complicated by winds and floating ice.

Magnetics and gravity in Alaska . . . Magnetics and gravity, used alone or in combination with seismic work, can add much to any exploration program in Alaska.

We know that igneous rocks ring most of the sedimentary basins and also occur within them, but the extent and nature of their occurrence is usually obscured by alluvium or other material covering the interior portions of the various basins. Magnetics and gravity both can quickly determine the presence or absence of igneous intrusions or extrusions within the sedimentary section.

When used in conjunction with seismic or gravity work, magnetic data can be used to avoid misinterpreting those gravity or seismic anomalies which appear as structure in the section but are actually caused by igneous rocks.

Igneous intrusives and extrusives occur in Alaska throughout the geologic time scale. The Jurassic, early Cretaceous, and Tertiary orogenies are particularly characterized by widespread igneous activity and mineralization.

Near the margin of the Copper River basin volcanic rocks occur interbedded with nonmarine formations, probably of Eocene age. Volcanics are exposed along the Talkeetna geanticline in the north part of the Copper River basin; however, geologists believe that a thick and more favorable Tertiary section occurs beneath the unconsolidated Quaternary depostits. This theory has been corroborated by evidence found in an interpretation of aeromagnetic data flow by the U. S. Geological Survey in this area.

The results of aeromagnetic surveys for several Alaskan areas have been made available by the USGS, either in flight strip form or as maps. The maps are suitable for determining the depth of basement and for outlining igneous intrusions. Although the flight strips do not contain sufficient information to predict this information accurately, they can be used to evaluate subsurface conditions approximately.

When used correctly and coordinated closely with local geology, gravity methods can be used to gather data considerably more detailed than those found with a general reconnaissance survey.

The variable and unusual thickness of the glacial till in Alaska is a problem for the gravity interpreter. Anomalies which aren't structural can appear due to drift thickness and the very great density contrast between the till and bedrock. Here again, close coordination of local geology with gravity data can correct this situation.

Planning must begin early . . . The best possible advance planning **must** precede every operation. For example, if summer exploration is planned, sufficient trails must be bulldozed during the winter months. Gasoline, spare parts and supplies must be stockpiled during the winter when these can be hauled in by truck or tracked vehicles.

The general cold weather problems with personnel and equipment that have to be met in Alaska are the same as those which have confronted any company engaged in work in Arctic-winter areas. However, the length of supply lines will increase the cost of transportation considerably in all Alaska's basins, with the exception of the Cook Inlet and Copper River regions. Transportation will vary with the area of interest, but in most cases a combination of land, air and possibly water transportation will be needed.

Camp facilities and costs . . . Tent camps or similar lightweight shelters can be used satisfactorily during the summer. Heated tents could be used in the winter, but the wind, snow, and cold have a very marked effect on the morale of men who must live in heated tent camps through an Alaskan winter.

Trailers are by far the best bet in Alaska. These can be towed to location while the ground is frozen and readied for summer operations, or when mounted on sleds they can be used throughout the winter.

An ideal camp location would be near a fair-sized lake. Float planes or helicopters can land during the summer, and the frozen lake can also accommodate planes equipped with skis after the freezeup.

Communication between field camps and operations bases is almost entirely by radio.

The cost of exploration in Alaska is high, and it is directly traceable to the difficulties involved in operation and transportation. The cost of a helicopter seismic survey runs from $60,000 to as high as $90,000 per month. Truck and track seismic field parties average about $50,000 to $60,000 a month.

It would appear that a considerable amount of oil awaits the drill in Alaska's sedimentary basins, and geophysics will play a major part in finding it. However, only those exploration programs which are conducted by experienced "plan-ahead" companies and contractors stand a chance of success.

Alaska has as its state flower the forget-me-not, and, in an Arctic exploration program, the "me" could well be those details which are so greatly magnified by 100-m.p.h. winds, 40°-below temperatures and 1,000-mile-long supply lines.

ALASKA ...in case you are interested

- *has an area of 586,400 square miles*
- *has at least nine possible petroleum provinces*
- *has the highest peak in North America (Mt. McKinley, 20,257')*
- *was discovered by a Dane, Vitus Bering, in 1741*
- *has a 6,640-mile coastline*
- *has, as its approximate geographic center, a point in latitude 63° 46', longitude 152° 20'*
- *has produced some oil since the early 1900's*
- *has, as its state flower, the Forget-me-not,*

A **HOT** item to remember is GSI experience in **COLD** climates . . . in Alaska and above and below the Arctic Circle in Canada. You can lessen the tough going in Alaska by discussing your seismic, gravity and magnetic exploration programs with GSI.

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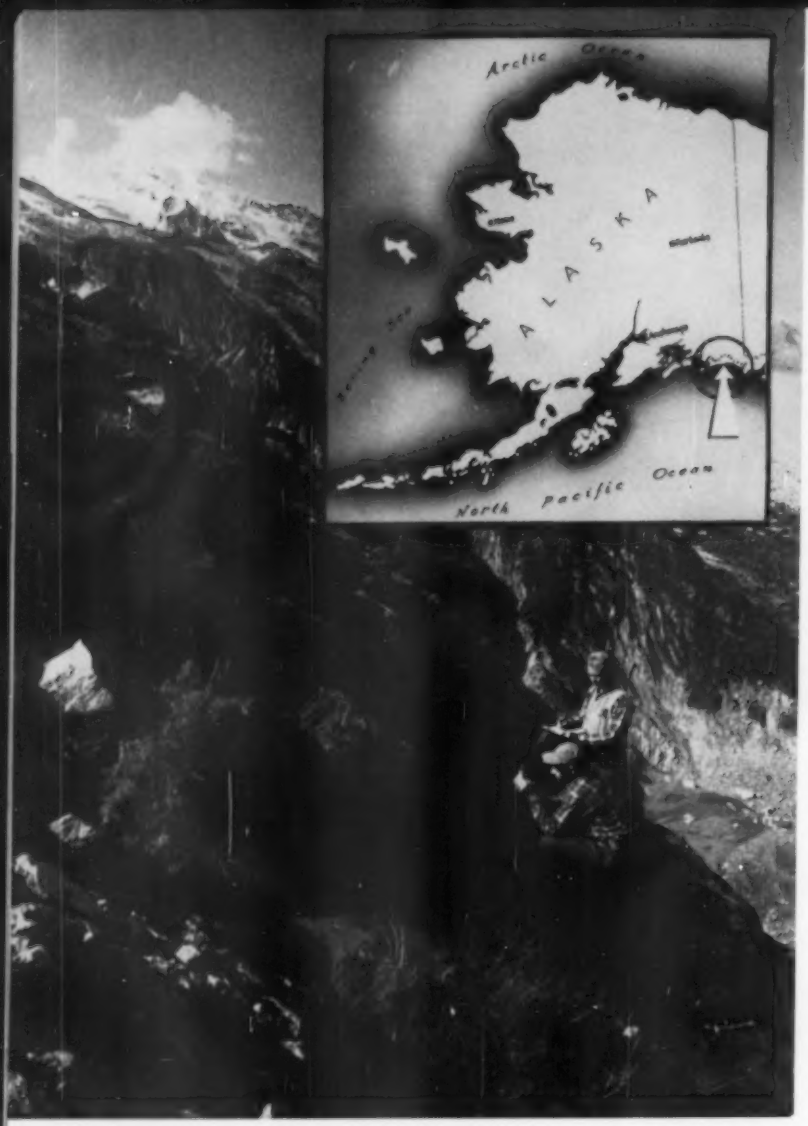


SOME OF THE WORLD'S MOST RUGGED TERRAIN awaits those seeking oil in southeastern Alaska. Circled area is Richfield Oil Co.'s Katalla-Yakataga concession, shown in detail on the next page. (Photo courtesy the Humble Way.)

Uncle Sam—Landlord

...He's shrewd and cautious

Like most lessors, now that oil's been found, he's insisting on tighter terms, earlier drilling, and harder bargains. The Richfield concession demonstrates the pattern for Alaska.

BY JOE REILLY
Washington District Editor

UNCLE SAM, who has the largest stake in Alaska's oil future, is a shrewd and cautious landlord.

As custodian of most of Alaska's 375,000,000 acres, he is dangling some tempting bait to lure major oil operators into the Alaskan search. But, like most landlords elsewhere, Uncle Sam is driving a little harder bargain now that Alaska's oil potential is becoming a reality.

The new emphasis on caution is illustrated by terms of the development contract for the Katalla-Yakataga area which the Interior Department, as leasing agent for the federal Government, recently approved. Richfield Oil Co., the operator, was given exploration rights on less than half the acreage included in a similar concession in the same area a few years earlier.

Like private landowners, the federal Government is insisting on early drilling. Richfield is required to spud its first well in the area before the end of this year. In addition, Richfield is to spend at least $150,000 on geological and geophysical operations there before January 1.

The Richfield contract covers 489,622 acres known as the Katalla-Yakataga tract No. 1. The concession is the south portion of the 1,060,000-acre area covered by an earlier development contract with Phillips Petroleum Co. Phillips gave up the acreage in 1957. The company, together with its partner, Kerr-McGee Oil Industries, Inc., drilled three wells on the tract before abandoning it.

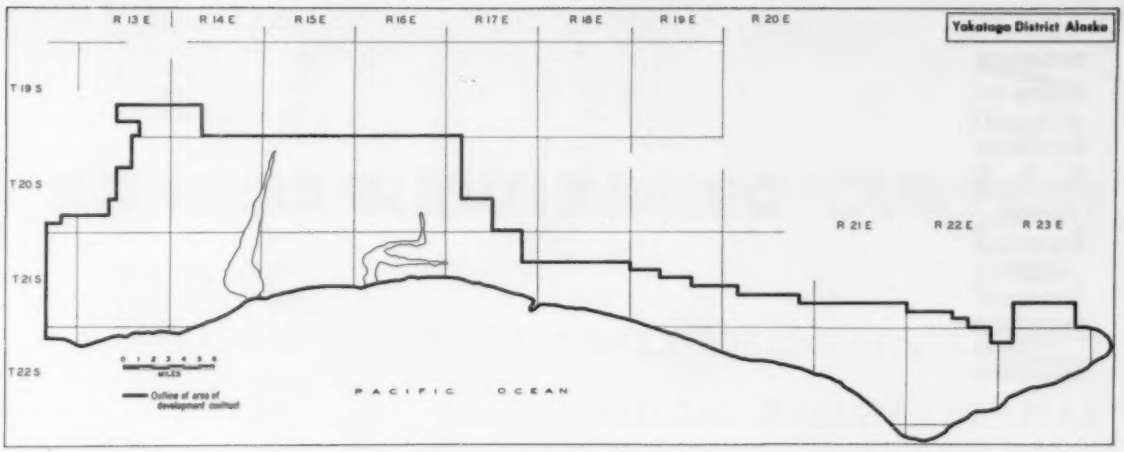
The Katalla-Yakataga area is along the coast of the Gulf of Alaska in the southeastern part of the new state. The concession lies east of Copper River and west of Icy Bay. Its west end is about 50 miles southeast of Cordova, Alaska.

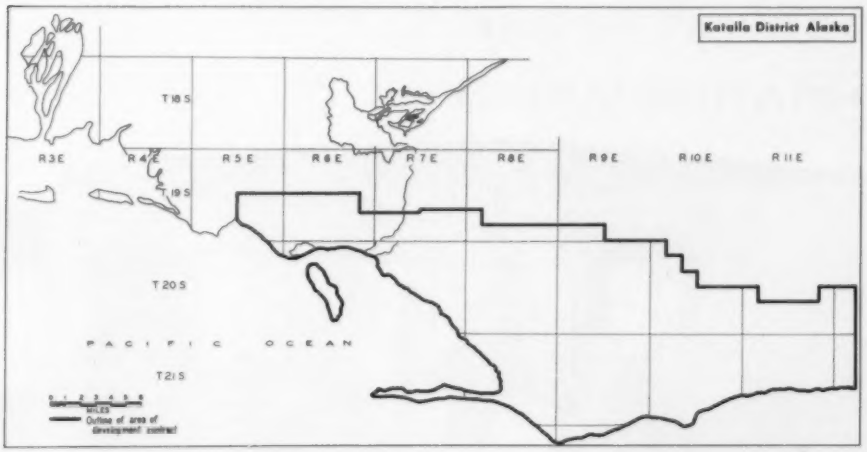
Oil's an Old Story

Oil is not new to the rugged, mountainous area where Richfield will drill. Surface oil seeps have been known to exist in the region for many years. Early in the twentieth century, the pioneering Chilkat Oil Co. drilled 18 shallow producing wells ranging in depth from about 360 to 1,800 ft. The company operated a small topping plant there for nearly two decades until the installation was destroyed by fire in 1933.

Major companies were slow to move into Alaska. This was due largely to federal regulations limiting the size of leases that could be controlled by a single company.

Most of the Katalla-Yakataga lease block was assembled in 1951 by Northern Development Co., a partnership formed by William T. Foran





THE RICHFIELD CONTRACT covers 489,622 acres in the Katalla-Yakataga Tract No. 1. It lies along the coast of the Gulf of Alaska in the southeastern part of Alaska, east of Copper River and west of Icy Bay. The two portions of the tract are outlined here in detail. It is the scene of several early wildcats. New exploratory drilling will be undertaken within the next 3 years.

and Ben G. Gellenbeck. Northern Development, in partnership with approximately 400 individual lessees, communitized the acreage and obtained Interior approval of a 10-year development contract with Phillips in 1953. Kerr-McGee later joined Phillips as a partner in the venture.

Phillips and Kerr-McGee had several encouraging oil shows, but failed to establish commercial production in any of their three wells.

After Phillips relinquished its contract in 1957, Richfield became interested in the area. Nathaniel J. Ely, Washington attorney representing Northern Development, spent months working out details or the new agreement to the satisfaction of the Interior Department. Officials in the U. S. Geological Survey and the Bureau of Land Management as well as Interior Sec. Fred A. Seaton himself carefully studied provisions of the new agreement before granting approval.

With the government-sanctioned development contract, the acreage will not be charged against the operators under the acreage limitation of the federal leasing law. That limit, formerly 15,360 acres per state, has been raised to 100,000 acres in Alaska and 46,080 acres in other states.

The contract gives Northern Development and the collective leaseholders a 5% first overriding royalty and a 2½% second overriding royalty. Richfield also is to pay lease rentals on the land.

Richfield has applied for a separate development contract covering the northern portion of the old Phillips concession. Interior has withheld action on this sector, covering some 571,000 acres. Other operators now are being given a chance to compete for it. The department has indicated that it will insist on early drilling if another development contract is approved for the remaining acreage. In that way, Interior officials reason, at lease two wells may be drilled on the old concession instead of one.

Other Provisions of Contract

Other provisions of the Richfield contract require the company to spend at least $250,000 on exploratory drilling or geological or geophysical operations in 1961 and at least $500,000 on exploratory drilling in 1962.

Federal law still gives Alaskan operators an incentive allowance to encourage wildcatting. Royalty payments to the Government have been set at 5% for a period of 10 years for the first production on a geologic structure. After that, the rate would be raised to the standard 12½% that applies to other federal leases.

Alaska's recent major oil discovery, in July 1957, set off one of the greatest leasing booms in history. More than 40 million acres of federal land in Alaska has been covered by leases or lease applications since.

If Sen. E. L. Bartlett of Alaska has his way, the Interior Department soon may have an additional 23,000,000 acres to put up for lease. Bartlett has introduced a bill in Congress to return the naval reserve in northern Alaska to the public domain. This is in line with President Eisenhower's recent suggestion that Congress consider the advisability of disposing of all the petroleum reserves held by the Navy. The sparsely drilled Alaskan reserve covers about 37,000 sq. miles.

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THE NEW 49ers

Michel Halbouty, independent, geologist, engineer, tells

Why independents should tackle Alaska

Says Halbouty . . .

> "This article is not designed to sell anyone on Alaska. Frankly, the fewer competitors there are, the easier it will be for those of us there. But the good independents are expected. It's their nature to get in on the ground floor of good things in new oil country."

MICHEL T. HALBOUTY is recognized in the oil industry as one of the most outstanding geologists and petroleum engineers in the nation. He is an independent operator and oil producer, with headquarters in Houston. He is a graduate of Texas A. & M. College and before going into business for himself, he served as geologist and petroleum engineer for Yount-Lee Oil Co. and the Glenn H. McCarthy interests.

Halbouty is credited with the discovery of dozens of new oil and gas fields in Texas and Louisiana. He is one of the most aggressive wildcatters on the exploration scene today, and his operations are widespread.

His entry into the Alaskan picture is an illustration of his forward thinking and optimistic approach to finding new oil in new places. He is now drilling his first wildcat well on Alaska's Kenai Peninsula, the Halbouty Alaska Oil Co.-King Oil, Inc., No. 1. Here he is shown discussing the project with R. E. Anderson, one of his attorneys. This article is his reply to a question put to him by The Oil and Gas Journal: "Why Did You Choose Alaska?"

THE SEARCH FOR oil in Alaska has been going on for many years—long before statehood was even a dream by its natives. Today, with modern techniques and equipment, the hunt is continued in a climate that ranges from that of Scandinavian winters to Chicago summers. This climate is the kind that has, in other countries, produced some of the most vigorous and enlightened cultures of the world. Alaska is indeed a land of contrasts where the eyes will always see things of extreme interest, and where the people are young, determined, vigorous, and growing.

We must realize that until now, 98% of the land and wealth of Alaska have been practically closed to private capital and investment. The mere fact that it has become a state of the union has multiplied its booming prospects a hundredfold.

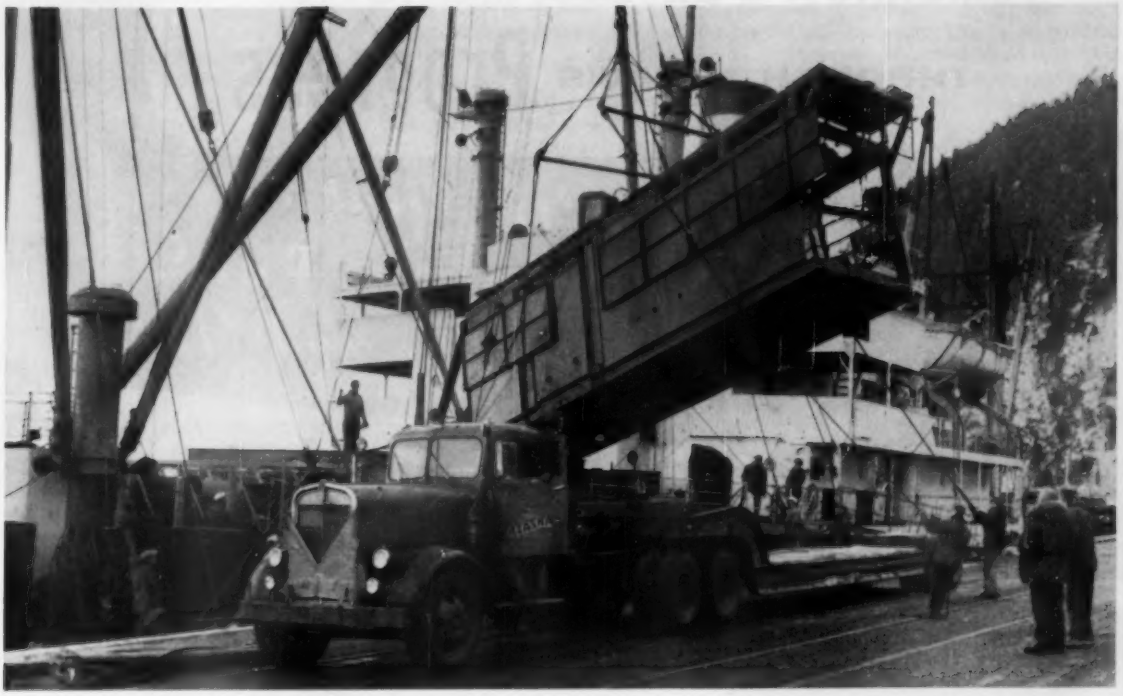
Alaska, from the standpoint of an independent oil operator, has an opportunity for gains similar to those that might be expected in an offshore operation in the Gulf of Mexico . . . and without the tremendous expense of competitive bidding for acreage. As long as the new state supports the noncompetitive leasing concept (except in areas that have already been proved capable of producing oil and gas), there will be more exploitation and more oil found.

Potential return 10 times more . . . Onshore operations in the United States involving expenditures of 2½ million dollars and more are considered to be good if the anticipated potential is in the neighborhood of 10 million barrels of oil. The same amount of money sunk in virgin Alaska may well find 100 million barrels.

It is true that more wells could be drilled in the continental United States for less money than in Alaska, with more chances to find the 10 million barrels. An independent could not stand too many dry holes in Alaska; therefore, his success must be early.

Initial Operation Begins

Alaska's potential has been studied by geologists for a long time. Over 15 years ago Wallace Pratt publicly stated



HALBOUTY'S EQUIPMENT was loaded on the freighter Indian Bear at Long Beach, Calif., and shipped to Seward, Alaska. There, it was placed on trucks . . .

that Alaska had tremendous oil potentials. The import of his statement has been proved by the rush of major oil companies and the heavy leasing program that has taken place there in the last few years.

I am generally convinced that Alaska's **early** petroleum potential lies in its southern region, mainly on the Kenai Peninsula. Therefore, my first drilling project is on the Kenai Peninsula. I am, of course, optimistic about its chances, otherwise I would not have allocated the amount of money necessary to drill it.

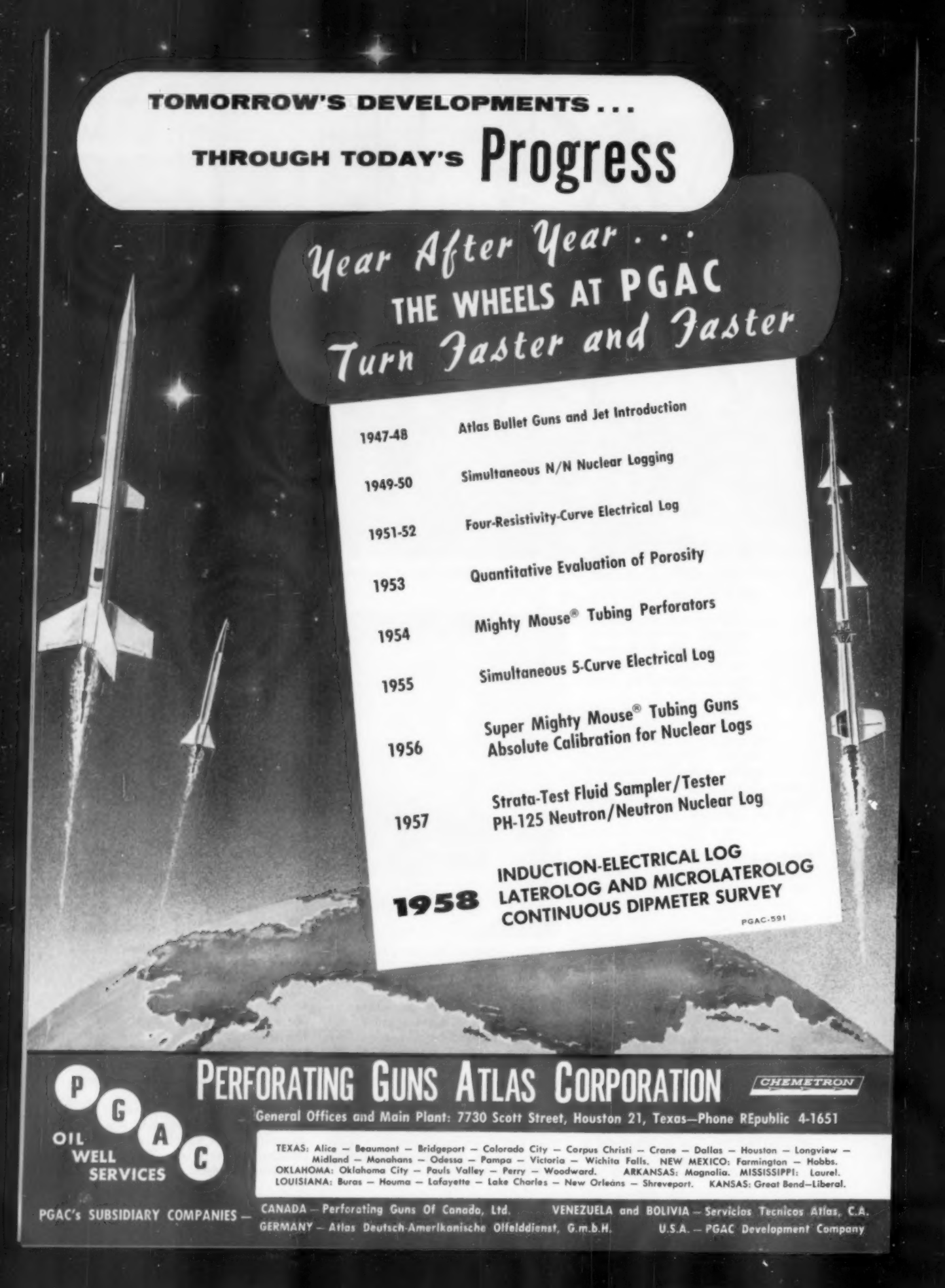
Off to a good start . . . A record has been set in moving my equipment to Alaska that will be hard to beat. Only 17 days after loading all of the equipment on a freighter at Long Beach, Calif., the well was spudded in Alaska. Within this time the boat landed at Seward and the equipment was trucked 125 miles to the location in the midst of winter conditions. This indeed is a tribute to the men associated with me and with the contractor, Coastal Drilling Co. This accomplishment proves what can be done without being hampered by interdepartmental decisions, bottlenecks, and red tape.

Planning essential . . . Exploration for oil in Alaska is not a bed of roses and it never will be. The geographical location of the new state forbids any so-called "normal" activity. Special plans must be made months in advance to take advantage of seasonal conditions. For an independent, a test well on the Kenai Peninsula cannot be decided upon in a committee meeting one day and a rig moved on the location the following day, as is normally done in the majority of provinces in the United States. Months of planning and investigation must be made in advance for geophysical, geological, and operating procedures.

and only 17 days after Long Beach, Halbouty Alaska Oil Co.-King Oil, Inc., No. 1 was spudded on the Kenai Peninsula. Coastal Drilling Co. is the contractor for the well.

Accent on youth . . . Young aggressive men must want to go to Alaska. The desire to accomplish and overcome problems in the unknown wilderness must be paramount in their thinking or they should stay home where things are easier and softer.

The supervision of the record rig-moving and spudding job was the responsibility of Chief Engineer Ted Dobson, 34 years old. There isn't a petroleum engineer in the business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with even 10 years' more experience who can top Dobson. He is an especially keen, energetic, intelligent young man, who has the ability to get things done well in a hurry. The writer is exceptionally high in his praise of Dobson and for the men who aided in moving and rigging up the equipment in the record time.

Another young man in my organization is Thomas E. Kelly, resident geologist at Anchorage. Kelly is only 27 years of age. He packed his family and moved to Anchorage to take over the geological work. Kelly loves the country and the people of Alaska. He has a high enthusiasm for his work. George C. Hardin, manager of exploration and production for the Halbouty oil and gas interests, is high in his praise of Kelly. Hardin thinks he is an exceptional geologist—but what makes men like that work, the writer and Hardin agree, is youth, a new country, and the challenges it presents.

Attractions for Independents

Alaska will no doubt attract more independents. Of course, the costs are high but actually costs are not low anywhere. The independent will be able to drill his wells cheaper once he finds oil, because he will not be hampered by offsets that will require him to spend many times as much money as is normally required in Texas, for instance, to protect and develop a property adequately. Chances are that the unit cost of producing oil in Alaska will be considerably lower than in the other oil-producing states.

Costs will shrink . . . It is true that the cost of drilling a hole in Alaska will be at least three times the cost of a well in the United States. That is principally because at present there are few oil-field-equipment and supply companies operating in the whole territory. In time the comparative costs will naturally come down but one must remember that spending three times as much for drilling a well, there is a chance of finding 10 or 15 times as much oil. Therefore, it is believed the odds still favor taking such risks in Alaska.

Markets ready . . . The market for Alaskan oil is already made. There is, for instance, the Far East market which could absorb all of the oil that could be found and produced in Alaska in the next 10 or 15 years. Then there is the Pacific Coast market. Oil can actually be produced and shipped to the Pacific Coast from Alaska at a lower price than it can be shipped from Canada.

Challenge unlimited . . . One of the attractions of Alaska is the challenge. The country is in its swaddling clothes. Vast domains are still unconquered. The rich geological promise of the country matches even that of the Middle East from a petroleum standpoint. It is no exaggeration that geologically this country holds as much promise for oil as the Middle East.

Almost every geologist who has taken a look at the country and then made a study of it has predicted great things. This is the opposite of the normal. In many great areas now known to be productive, early geologists have said there was little chance of success. But here, the best geologists have said the sky is the limit.

People are daring . . . Another thing in Alaska's favor is its people. Alaska is a cold, difficult country. The people there now and those going there in the next few years are cut from the same cloth as pioneer Americans. They are people willing to work for an opportunity under the most difficult conditions. These are rare people today. Others simply stay in Texas or California or Ohio where things are easier. But the Alaskan is willing to make a great personal sacrifice for the opportunity of getting a real stake in life. Any wildcatter who is actually still a wildcatter at heart is bound to feel at home among these people and is apt to derive a great pleasure from building a new state with them.

Negative Factors Dispelled

Many have unjustly criticized the oil possibilities in Alaska. For instance, you hear that field operations will be limited to a very few months out of the year. That is preposterous. Investigations have proved that Alaska operations can be maintained around the calendar and around the clock.

"OK, OK, we'll throw in a 2-week vacation in Florida if you'll just sign . . ."

It has been said that there are no transportation facilities. The fact is that there are already some good roads and the Government is planning many more. Heavy equipment and tools may be transported from the United States to several key areas in Alaska over the Alcan Highway. But the absence of roads in all but the more populated areas does create a temporary problem of unloading and transporting of supplies.

If the obstacles to transportation can be overcome in the swamps of Louisiana or the rugged country of the Four Corners area or the mountains of Colorado or the deserts of North Africa and the Near East or even the Gulf of Mexico, there will be few transportation obstacles in Alaska that will not be overcome. All it will take is for someone to find a substantial amount of oil in any part of Alaska. After that, the problems that now seem great will shrink to nothing.

One must bear in mind that Alaska is a virgin area for oil and gas prospects. The mere fact that at least nine major basins exist where exploration for petroleum is warranted, places Alaska among the top areas in the Western Hemisphere where new oil and gas reserves may be found.

The first great oil area in Alaska will be in the Kenai Peninsula where we already know there is oil. There will be a substantial drilling program there in a very few months if only a few more wells come in.

The next target will be the Porcupine basin northeast of Fairbanks. That is because the geology there is as good as it is in the Kenai country and because the Alcan Highway goes right to the Porcupine basin country.

Instead of spending their money overseas in countries where, even if they find oil, they will never know from day to day whether they own it or some revolutionary government owns it, they can take that money to Alaska and find just as much oil. Furthermore, they will be spending their money to add to their own country's wealth and security rather than spending it to build up some possibly antagonistic foreign power.

In answering The Oil and Gas Journal's request to write this article as to why I chose Alaska, I hope that this may explain some of the reasons for my accepting one of the most important challenges of my career. At this writing, my hopes were never higher.

HUMBLE 1 BEAR CREEK UNIT RIG stands on hill overlooking camp's water supply. This operation in the Kanatak Bay may ultimately cost as much as Secretary of State Seward paid the Russians for Alaska in 1867. Shell Oil Co. is a partner in this venture. Contractor is Rowan Drilling Co.

Who's up there . . . and what are they doing?

Here's a rundown . . . and some predictions

BY JOHN R. RODERICK
Alaska Scouting Service,
Anchorage, Alaska.

THERE IS EVERY indication that the 1959 season in Alaska will be the most active of all. At least 25 major oil companies and a growing number of independents will have geology parties in the field and at least 10 wells are expected to be drilled during the year. This will be twice as many rigs active in Alaska as were drilling in 1958.

The best indication of the increased activity is the number of oil companies which are establishing permanent offices in Alaska. In most all cases they are locating in Anchorage, financial center of Alaska, as well as being in the middle of the South Central Alaska oil province, the most active to date.

In July 1957, when Richfield Oil Corp. brought in its 1 Swanson River Unit on the Kenai Peninsula, only one company, Phillips Petroleum Co., had a permanent office in Alaska. Even at that time Phillips had laid plans to withdraw its small staff from Anchorage. Since that time more than 15 companies have established permanent offices in Anchorage and several more are expected before the 1959 field season begins in April. In addition, oil-field supply companies are entering Alaska at the rate of two or three per week. Companies with offices now in Anchorage include: Standard Oil Co. of California, Richfield Oil Corp., Union Oil Co. of California, General Petroleum Corp., Western Gulf Oil Co., Sunray Mid-Continent Oil Co., Humble Oil & Refining Co., Ohio Oil Co., Superior Oil Co., Continental Oil Co., Sinclair Oil & Gas Co., John W. Mecom, and Michel T. Halbouty. Others expected shortly are: Shell Oil Co., Colorado Oil & Gas Corp. (now drilling at Yakutat), Pan American Petroleum Corp., Amerada Petroleum Corp., British-American Oil Producing Co., Texaco (Alaska), Inc., and several more independents.

Standard of California and Richfield are now drilling their third development well in the Swanson River Unit on the North Kenai Peninsula, approximately 40 air miles south of Anchorage. The 4 Swanson River Unit is presently drilling below 11,000 ft. and was spudded on January 3, 1959. The 1 Swanson River Unit, the discovery well, is presently shut in for a pressure-buildup test after production of 500 bbl. per day, and 2 Swanson River Unit tested an average rate of production of 849 bbl. per day on a 25-day test. It has presently beaned back to 500 bbl. per day. The 3 Swanson River Unit was nonproductive at total depth of 11,653 ft. at a cost of $700,000. Estimated time for each development well is 90 days. Locations have been prepared for 5 and 6 Swanson River Units and it is expected that both will be drilled during 1959.

Crude has been trucked from the Swanson wells to Seward, Alaska,

ALASKA CONSOLIDATED OIL 1 Zappa is working in the Iniskin Bay area on the west shore of the Cook Inlet. Contractor is Coastal Drilling Co., Bakersfield, Calif.

where it goes by tanker to Standard of California's Richmond, Calif., refinery. Estimates of production before a pipeline to Seward, Homer, Kenai, or Anchorage would be "economically feasible" are set at 6,900 bbl. per day. Present production from the two Swanson wells approximate 1,000 to 1,500 bbl. per day. A small refinery is said to require 14,000 bbl. per day.

Earlier in 1958, Standard-Richfield drilled the 1 Deep Creek Unit well on the southern Kenai Peninsula to total depth of 14,221 ft. at an estimated cost of $975,000. A dry hole, it has warranted Standard doing more seismic work and reevaluation of the unit and surrounding area.

Approximately 5 miles to the southwest of the 4 Swanson well Michel T. Halbouty, of Houston, independent, is drilling the Halbouty Alaska Oil Co.-King Oil Co., Inc. 1. Halbouty is operating for King Oil, Inc., of Wichita Falls, Tex., on an original lease of 2,240 acres taken by Alaska Oil & Mineral Co., Inc., of New York City. It is presently drilling below 5,000 ft. and was spudded on January 31, 1958.

Halbouty has been active in Alaska picking up leases both on the Kenai Peninsula and in other basins and has also announced plans to begin an office building and hotel in Anchorage this spring to be completed in 1960, known as the Hickel-Halbouty office building and Captain Cook Hotel. It will have 130,000 sq. ft. of office space and 200 hotel rooms and is estimated to cost 10 million dollars. Halbouty's partner in this venture is Walter Hickel, Anchorage contractor and hotel owner. Hickel and Halbouty are also negotiating the purchase of several of the small telephone and communication companies in Alaska. This appears to tie in with the U. S. Government's announcement that it expects to offer for sale shortly the Alaska Communications System (ACS), the Army-owned and operated Alaska telephone and telegraph company.

Iniskin Bay Area

Across Cook Inlet from the southern tip of the Kenai Peninsula, Alaska Consolidated Oil Co., Inc., of New York, is drilling on the Iniskin Peninsula. This is the same area where Russell E. Havenstrite, Los Angeles independent, drilled two wells, one in 1938-40 and the other in 1953-56. Both had good oil and gas shows, but were nonproductive. Alaska Consolidated Oil spudded December 25, 1958, and is presently making good progress below 3,500 ft.

At Yakutat, on the Gulf of Alaska, Colorado Oil & Gas Corp., Denver, is drilling its third Yakutat well. Associated with Colorado are Frankfort Oil Co. and Continental Oil Co. These three companies control nearly a million and a quarter acres under a development contract awarded in April 1956. High gas pressures have been encountered below 10,000 ft. Colorado presently is drilling below 10,500 ft. with similar gas shows. An all-year-round harbor at Yakutat would permit tankers to transport oil or liquefied gas to U. S. refineries.

North, along the Gulf of Alaska, Richfield was awarded in January 1959, a development contract on 489,622 acres in the Katalla-Yakataga basin, where between 1953 and 1957 Phillips and Kerr-McGee drilled three wells on approximately a million acres and found no production. Richfield is expected to begin exploration as soon as weather conditions permit.

The contract calls for expenditures of $150,000 on geological and geophysical work during 1959 and the spudding of one well. This is to be followed by expenditures of $250,000 on exploration drilling in 1961 and $500,000 in 1962.

Depth Record

West, across the Gulf of Alaska on the Alaska Peninsula, Humble is continuing to drill its 1 Bear Creek Unit well below 14,300 ft., making it the deepest well ever drilled in Alaska. Humble is expected shortly to make up its mind whether to continue drilling at this location or move to one of two other units formed with Shell in the same area.

Alternatives are to drill in the Cook Inlet basin or Copper River basin in both of which Humble has done extensive geophysical work. Humble is reported to have spent over 5 million dollars on the Bear Creek well, making it the most expensive well drilled in Alaska. Drilling on the well has continued for nearly a year and a half. Weather conditions are a challenge. Subzero winds reach 150 m.p.h.

Just last month, Union Oil and Ohio Oil were awarded a development contract covering approximately 229,000 acres just northwest of Anchorage in the Knik Arm area. The contract calls for Union and Ohio to spend $450,000 and drill three exploratory wells, one each in 1960, 1961, and 1962. Union and Ohio, who work jointly in the Cook Inlet basin, have extensive holdings on the Kenai Peninsula.

Much of the fee acreage in Alaska is located on the Kenai Peninsula, and, with the coming of statehood, regulations as to what lands are covered by inland navigable waters have not

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STANDARD OF CALIFORNIA is drilling the fourth test in the Swanson River Unit with this rig. Richfield Oil Co. operated the first discovery well. Associated with Standard of California and Richfield are Union Oil Co. of California and Ohio Oil Co. et al. Photo by Ward Wells, Anchorage. Courtesy The Kodiak Mirror.

as yet beeen forthcoming from the Interior Department. Exploration drilling on the Kenai has been somewhat slowed down by leases not issuing due to this lack of regulations.

Union recently purchased several established marine terminals for increased distribution of petroleum products in Alaska. At the present time, Union and Standard of California have complete distributing facilities throughout most of Alaska. General Petroleum has for many years had a small sale outlet at Ketchikan, Alaska, and during the past year Shell began moving cautiously into the new state followed by Texaco and British-American. With the increase in population, marketing is expected to continue to grow.

On the west side of the Alaska Peninsula in the Nushagak basin, Bristol Bay, General Petroleum will begin a wildcat by June 15, 1959, on acreage controlled by Great Basins Petroleum Co. and a group of smaller oil companies. General Petroleum has until January 15, 1960, to choose up to 300,000 acres lying between the mouth of the Kvichak River and Ugashik Bay on the east side of Bristol Bay. General Petroleum also may, during the 10-year contract term, select additional acreage subject to well obligations.

Great Basins, representing a number of smaller oil companies, continues to hold a sizable amount of acreage in the basin, as does Husky, Franco Western Oil Co., and several others. Development contracts for this area similar to the ones awarded Richfield and Union-Ohio are being sought in this basin by several operators.

Year-'Round Geophysical Operations

Geophysical operations as well as drilling operations have continued year around in Alaska. Standard-Richfield and Union-Ohio have continued to do seismic work on the Kenai Peninsula, both with helicopters and with muskeg tractor equipment. In addition, Standard of California, acting as operator for 11 major oil companies, began marine seismic work in the Cook Inlet last January and is presently shooting a 12-mile grid starting at the southern Kenai Peninsula and working northward toward Anchorage. The cost of the program has been set at $1,225,000.

Western Geophysical Co. of America and Offshore Navigation, Inc., of New Orleans, are working from four 90-ft. boats and are taking elaborate precautions not to injure any marine life. The companies involved in the group include Ohio, Pan American, Shell, Richfield, Sunray Mid-Continent, Superior, Texaco (Alaska), Inc., Union, Western Gulf, and Continental.

Northwest of Anchorage in the Susitna basin, Humble has done extensive geophysical work beginning in July 1958 and ending only recently. Humble is also doing seismic and gravity work northeast of Anchorage in the Copper River basin, where Tidewater Oil Co., Skelly Oil Co., Kewanee Oil Co., Union-Ohio, Honolulu, and other companies have extensive acreage holdings.

On the Kenai Peninsula, Phillips is presently doing seismic work from track vehicles on approximately 50,000 acres south of and adjacent to the Swanson River Unit. Phillips with its considerable experience in Alaska, has stepped up its Alaska program and can be expected to show renewed signs of life.

Leasing continues in the three interior basins: The Bethel-Kuskokwim at the southern extremity of the Kuskokwim River; the Kateel-Koyukuk basin and the Kandik-Porcupine basin northeast of Fairbanks.

Drilling on Arctic Slope

On the Arctic Slope, where in Septemper 1958, Gubik gas field was put up for competitive bid by the Interior Department, Alaska Propane Co., Inc., of Fairbanks, has sold its interest in the Gubik leases and pipeline right-of-ways to Colorado Oil & Gas Corp. If reserves prove adequate and military needs in Alaska warrant, Colorado will build a 402-mile gas line from Gubik field to Fairbanks at an estimated cost of $42,000,000. At the present time, Alaska Sen. E. L. Bartlett is attempting to abolish Naval Petroleum Reserve No. 4 and with it, the 2-mile buffer zone surrounding the reserve, which extends into Gubik field. The Navy has indicated its willingness to relinquish this buffer zone to private exploration. Colorado has purchased two rigs from the Navy stored since 1953 on the Arctic Slope, and hopes to make use of much of the Navy equipment on hand.

Political Conditions

Legislation in the new state has thus far had little time for consideration of the oil and gas industry. The new state government has had first to establish an executive department, a judicial branch of the Government, establish salaries for government officials and, generally, pull itself up by its own bootstraps. Informed observers believe that a Natural Resources Department embracing the mining, agriculture, oil and gas, and possibly, the fishing industries, will be established, placing in the hands of the director of each of these branches within the Resources Department the implementing of the state's laws, rules and regulations, etc. Members of the petroleum industry may expect that orderly development of Alaska's oil and gas will take place.

Informed observers believe that what little legislation is necessary will be forthcoming within the next several months. The proposal getting the most

THE 3 YAKUTAT UNIT of Colorado Oil & Gas-Frankfort Oil-Continental Oil is drilling ahead 4 miles east of the village of Yakutat. This venture is in the Cape Fairweather-Icy Bay area.

HALBOUTY-KING 1 "HALASKINO" is drilling in the Swanson River area on the Kenai Peninsula. Contracting this undertaking is Coastal Drilling. Record was set loading rig at Long Beach to actual spudding in Alaska—17 days!

favorable reaction at the present time from local officials is that the state should be able to determine when lands are reasonably believed to contain oil and gas and therefore subject to competitive bid. Submerged lands will undoubtedly be offered on a competitive basis. Acreage limitation on state lands will probably be between 100,000 under lease, 200,000 under option or alternatively a total of 500,000 under all forms of competitive and noncompetitive filings.

Under terms of the Statehood Act, Alaska is entitled to select approximately 105 million acres over a period of 25 years. For this purpose, as well as to administer the land, once it is selected, Alaska Land Department has been established and its announced policy is to recognize all valid existing federal offers for oil and gas, except those on known or producing structures or those structures reasonably believed by the state to contain oil and gas. Once the state gained jurisdiction over those lands, they would be offered competitively. Existing federal oil and gas leases will be recognized as valid by the state.

As a practical matter, the state, for the next 10 or more years, will not have control over most of the land now believed to be favorable for oil and gas. In most cases, the leases or offer to lease will have to run their full 10-year federal term before the state may offer them under its jurisdiction. Immediately, however, the state will have jurisdiction over its submerged lands including its inland navigable waters. Anyone familiar with Alaska knows of its vast tidelands and lakes and streams. The state will undoubtedly begin immediately to receive bonus bids on some of these water bottoms.

Summary

The next 2 years will see aggressive exploration in Alaska by at least 25 major oil companies. These same companies, plus a growing number of independents are permanently establishing offices in Anchorage. Independents will be watching the Halbouty-King wildcat well on the Kenai Peninsula for signs that independents can operate in this high-cost country.

Good reserve possibilities look promising but new discoveries in basins other than the Cook Inlet will be necessary to maintain the optimism.

With several more wildcat discoveries, Alaska will be the "hottest" exploration area for American dollars.

Incidentally, the Anchorage Land Office is now the largest (53 persons) of any in the United States. Fairbanks has approximately 38 persons.

ALASKA'S ARCTIC SLOPE...

Costs are high per operating day, but are low per barrel of reserves

BY R. J. BURNSIDE
Consulting geologist, Denver

ARCTIC SLOPE contains bulk of Alaska's proven oil reserves. Northern position of area indicates why climate affects operations. Fig. 1.

IT APPEARS that a potentially major oil province has been opened up by the recent decision to open the Arctic slope of Alaska to leasing. Nine oil and gas fields are already known from the U. S. Navy-U. S. Geological Survey exploration program. Structural and stratigraphic conditions are such that other fields are likely to be found in the area opened to leasing.

Operating conditions are difficult but are no real barrier to successful exploration and development. Costs per operating day are high, but costs per barrel of reserves are exceptionally low.

The immediate problem confronting operators is the development of sufficient reserves to justify a pipeline to the Fairbanks military and civilian markets and eventually to the all-year ports on the south coast of Alaska. A 1953 study made for the Navy by Arctic Contractors indicated that the reserves at Umiat alone were sufficient to economically justify such a pipeline.

The problems involved in the development of Alaska's Arctic slope should not be minimized. The twin problems of isolation and climate will involve large cash expenditures. A detailed study of the Arctic slope oil province, however, shows that petroleum potentials are more than sufficient to be attractive and costs per barrel of reserves may be substantially lower than in the other 48 states.

For example, in spite of their exceptionally high costs (Reed p. 173), the Navy found oil at an average cost of 50 cents per barrel or about 600 bbl. of oil for each foot of hole drilled (as compared to a national average of about 20 bbl. per foot of hole drilled). High operating costs are thus offset by exceptionally low per barrel discovery costs. It is estimated that with the use of the extensive geological and geophysical data plus general know-how in Arctic operations already acquired by the Navy, present per barrel discovery and development costs should be less than half that experienced by the Navy.

Previous Exploration

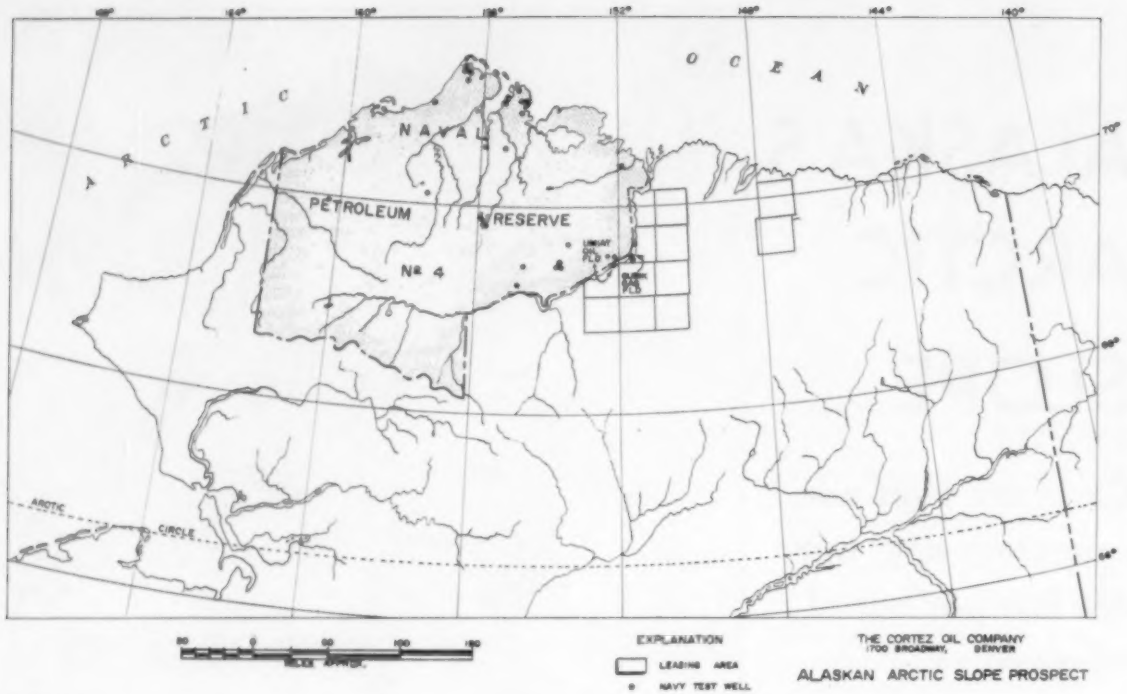
Of Alaska's 375 million acres, over 100 million have been classified as geologically favorable for oil development. These favorable areas, together with the currently known oil and gas fields, are shown in Fig. 1.

Two significant oil fields have been discovered, Swanson River and Umiat. There is one significant gas field at Gubik.

It is important to note that Alaska's largest fields are both located on the borderline between the Naval Petroleum Reserve and the lease area. This would tend to indicate that the lease area covers some of the most favorable oil lands in Alaska.

The API reports that some 30 companies or independent operators have already earmarked over $100,000,000 for Alaskan oil exploration within the next 1 or 2 years. An excellent market outlet for Alaskan crude seems assured. The potential markets lie in Japan, the Pacific Northwest, the West Coast, and Alaska itself. Generally all indications point toward Alaska's becoming one of the most active areas for future domestic oil exploration.

Owing to the vastness of Alaska, and to the fact that her most promising regions have recently been opened to leasing, the exploratory effort has



LEASE AREAS, represented by blocks, lie east of Naval Petroleum Reserve No. 4. These lands, though unsurveyed, were opened to filing in 1958. Fig. 2.

so far been minimal. The most significant exploration has been that of the U. S. Navy and the U. S. Geological Survey in Naval Petroleum Reserve No. 4 on the Arctic slope. This program includes 36 tests, of which 25 were wildcats. It resulted in the discovery of three oil fields and six gas fields—the most important being Umiat oil field with some 70 million barrels of reserves, and Gubik gas field with about 900 M.M.c.f. of reserves.

This exploration performance in itself is one of which a professional oil company could well be proud. The extensive data acquired, all currently available, furnish incoming organizations a sound basis on which to start an intelligent exploration effort. More important, the combined USN/USGS program proved conclusively that the Alaskan Arctic slope is an area with large reserves available at shallow depths and at fairly low discovery costs. Leases are reasonable; most of the preliminary geological work has been done, and drilling equipment is in the area. Drilling costs are the cheapest in Alaska.

Persons unfamiliar with the Arctic slope often view it as a remote area posing unsurmountable operational problems. The Navy program proved that operating conditions are not so severe as are commonly imagined. A true understanding of operating conditions is important to appreciate the potential of this area. A brief discussion of the subject in included for those not familiar with it.

Alaska Propane Co., designated as operator of the newly formed Gubik Unit, is now assembling drilling equipment preparatory to its development of Gubik field. It has arranged financing for a gas pipeline from Gubik to Fairbanks (dotted line on Fig. 1). Engineering studies made of this project indicate that an oil pipeline of 30,000-bbl. capacity can be built from Umiat to Fairbanks for about $25,000,000.

A products pipeline of 10,000 bbl. of oil per day exists from Fairbanks to Haines (solid line on Fig. 1), on the southeast coast. The economic advantage of constructing a 30,000-bbl. per day refinery of throughput at Fairbanks, to supply 20,000 bbl. per day of products to the terminal facility at Haines is obvious. Finally, a contract study made in 1953 for the Navy by Arctic Contractors showed that the reserves in Umiat field alone were sufficient to justify the construction of a pipeline from there to the southern coast.

The lease area covered by the map (Fig. 2) is exclusively public domain.

. . . About the author

R. J. Burnside has specialized in Alaskan and foreign exploration since the summer of 1957. In the summer of that year he was in charge of field exploration in the Koyukuk basin for Paul G. Benedum. He has recently taken the position of executive vice president with Cortez Oil Co. in Denver, but maintains an active consulting practice.

Burnside received his B.A. and M.S. degrees from University of Southern California in 1949 and 1950. He joined the fuels branch of the USGS and worked in various capacities in the field of exploration and exploration research. His experience extends from underwater (aqualung) mapping of the sea floor in California to subsurface mapping and reef research in Texas. He authored several papers for the USGS before resigning in 1957.

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It was withdrawn from leasing by Public Land Order 82 on January 22, 1943, and was restored to leasing by PLO 1621 on April 18, 1958, effective as of notice published in the Federal Register of July 29, 1958. An unusual feature of this notice was that the lands, although unsurveyed, were to be filed upon subject to a lease grid approved by the Bureau of Land Management, rather than by conventional metes and bounds descriptions tied to an established corner of the public survey.

The lands opened to offers were gridded to townships and the townships subdivided into 6 blocks; Blocks 1, 2, 5, 6, 7, and 8, and each contains 4 sections, or 2,560 acres. Convergence correction was accomplished by reduction of the western tier of blocks, namely Blocks 3, 4, and 9, which vary in acreage from about 2,450 to about 2,555 acres. This procedure served two useful purposes: (1) it eliminated the over-all laps and hiatuses which normally characterize lease coverage on unsurveyed lands; (2) since the lease grid showed lakes and streams from the USGS quadrangle sheets, it afforded by employment of a cultural match correlation of the lease blocks with the known geological structures. This enabled the offerer to determine accurately which geological feature he was filing on—a determination uncommonly rare in unsurveyed lands, particularly in Alaska.

The notice of July 29, 1958, provided for an initial simultaneous filing period of 60 days which expired at 10 a.m., September 29, 1958. On October 1 and 2, 1958, the BLM in Fairbanks conducted a public drawing for the establishment of first, second, and third priorities of the offers on each block of land on which more than one offer was filed.

The lands opened for leasing comprised 1,501 blocks, or about 4 million acres. Of these, 608 blocks, or roughly 1.5 million acres, were subject to one or more offers. There were 7,406 offers filed during the simultaneous period, for an average offer density of 12 per block. Offer density ran from none in some areas to 120 per block in other areas.

Geology

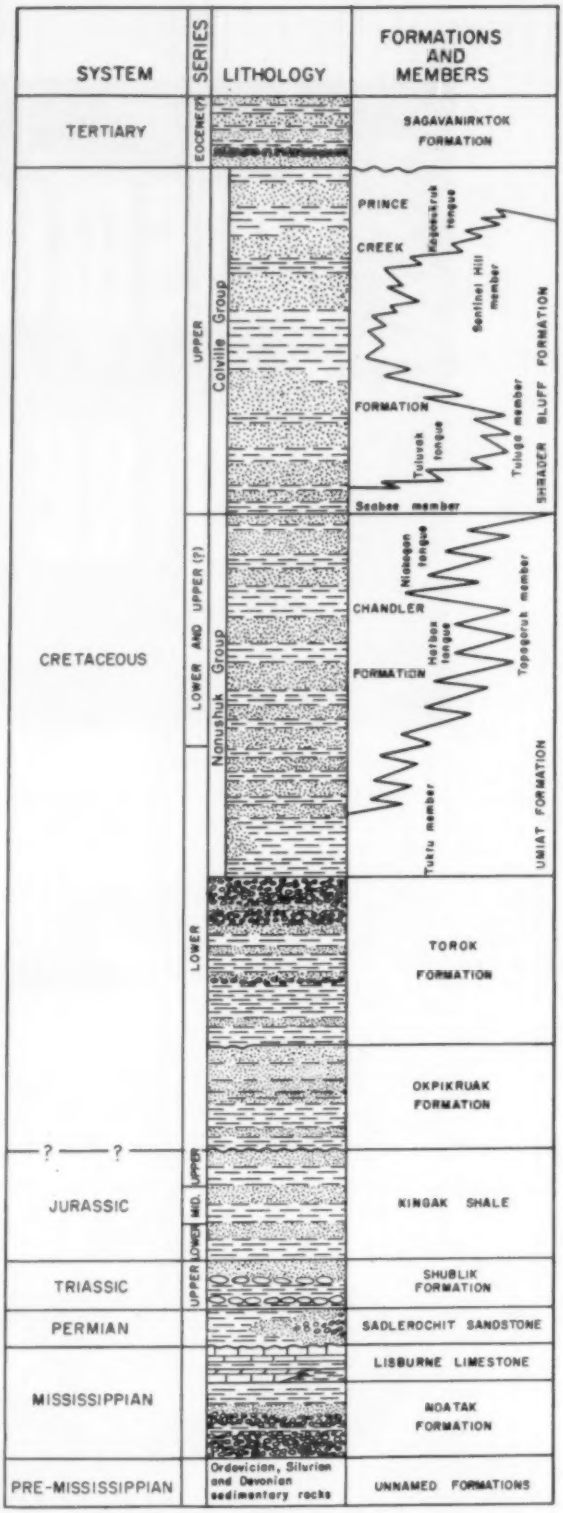
In the 10-year period from 1944 through 1953, the U. S. Navy and USGS conducted an extensive geological investigation of the Alaskan Arctic slope. This included evaluation of Naval Petroleum Reserve No. 4. This NPR-4 program made use of every available investigative tool—surface mapping, photo mapping, airborne magnetometer, gravity meter, seismograph, and the drilling rig.

The Arctic slope has been subdivided by the USGS into four major physiographic and geologic provinces (Payne et al., 1951). These provinces trend in east-west subparallel belts with the Brooks Range which is itself the southernmost province. Northward from the Brooks Range, these provinces are respectively known as the Southern Foothills province, the Northern Foothills province, and the Arctic Coastal Plain province.

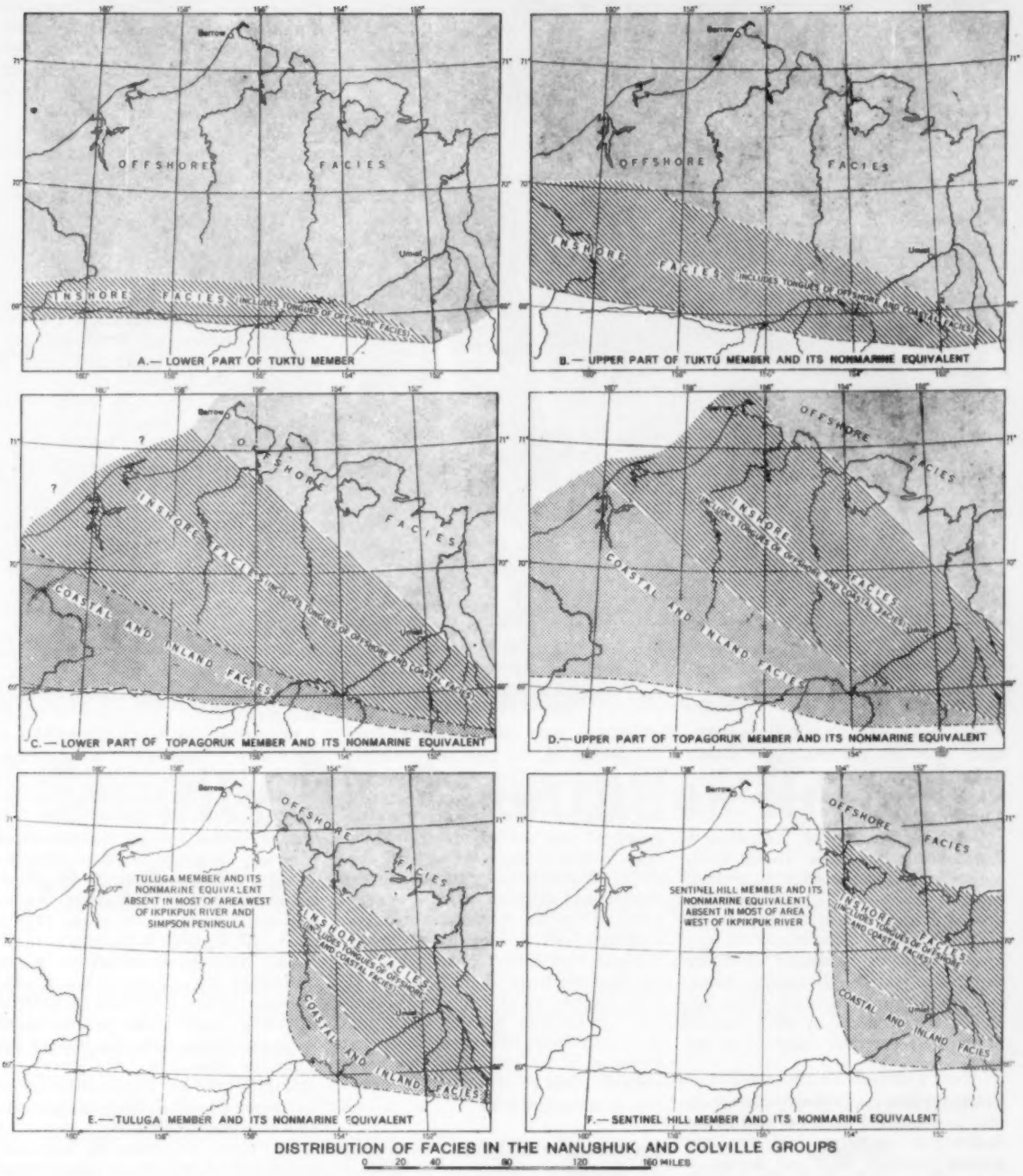
Physiographically, these provinces successively run the gamut from the extremely rugged terrain of the Brooks Range with elevations in excess of 8,000 ft. to the flat, monotonous lake country of the Coastal Plain which lies only a few feet above sea level.

Geologically, these provinces are also natural subdivisions. The Brooks Range is an area of extremely complex folding, thrust faulting, and intrusion. The Southern Foothills belt is similar to the Brooks Range, but is less complexly folded, faulted, and intruded. Exposures of Mississippian through Cretaceous rocks are present in this belt, but Precambrian basement exposures are confined to the Brooks Range.

The Northern Foothills belt is an area of broad and extremely long open folds with few low-angle overthrust



KNOWN OIL AND GAS RESERVOIRS of the Arctic Slope are confined to sandstones and graywackes of Cretaceous-Nanushuk and Colville groups. This columnar section is adapted from Payne et al. (1951). Fig. 3.


OFFSHORE FACIES
INSHORE FACIES (INCLUDES TONGUES OF OFFSHORE FACIES)
A.— LOWER PART OF TUKTU MEMBER
B.— UPPER PART OF TUKTU MEMBER AND ITS NONMARINE EQUIVALENT
COASTAL AND INLAND FACIES
C.— LOWER PART OF TOPAGORUK MEMBER AND ITS NONMARINE EQUIVALENT
D.— UPPER PART OF TOPAGORUK MEMBER AND ITS NONMARINE EQUIVALENT
TULUGA MEMBER AND ITS NONMARINE EQUIVALENT ABSENT IN MOST OF AREA WEST OF IKPIKPUK RIVER AND SIMPSON PENINSULA
E.—TULUGA MEMBER AND ITS NONMARINE EQUIVALENT
SENTINEL HILL MEMBER AND ITS NONMARINE EQUIVALENT ABSENT IN MOST OF AREA WEST OF IKPIKPUK RIVER
F.— SENTINEL HILL MEMBER AND ITS NONMARINE EQUIVALENT
DISTRIBUTION OF FACIES IN THE NANUSHUK AND COLVILLE GROUPS
0 20 40 80 120 160 MILES

FACIES MAPS adapted from Payne et al. (1951) indicate that inshore facies of each respective member is considered most favorable area for petroleum accumulation. Fig. 4.

faults and no intrusives. In the northern part of this province, the folds become broader, more open, and have more gentle dips on the flanks.

The Arctic Coastal Plain is characterized by very gentle dipping to flatlying sedimentary rocks. Typically, it has a thin veneer of Quaternary unconsolidated sands and gravels. Tertiary age sediments are confined to this belt. Folds in this province appear to be confined to the area east of NPR-4. These are the broadest and most gentle folds in the Arctic slope region.

Stratigraphy*

Pre-Mississippian . . . Pre-Mississippian sedimentary rocks were only cursorily studied during the exploration of NPR-4. From exposures in the Brooks Range, carbonate rocks of Ordovician and Silurian age are known, as well as clastic and carbonate facies of Devonian age. Fig. 3 is the columnar section.

Mississippian . . . The oldest rocks studied in detail were those of the Noatak formation. In the Brooks

*The stratigraphic nomenclature used throughout this paper is that of Payne et al., in their 1951 USGS Oil and Gas Investigations Map 126.

POSITIONS of known and indicated structures are displayed on the area immediately adjacent to Umiat and Gubik fields. These structures were opened to public leasing in July 1958. Fig. 5.

Range, these exceed 5,000 ft. in thickness. They are predominantly clastic rocks ranging from pebble to cobble-size quartz-chert conglomerates to dark bituminous shales.

Overlying the Noatak formation is the Lisburne limestone. Its thickness ranges from a wedge edge somewhere between the Barrow "high" and the Brooks Range to about 4,000 ft. in the western part of the Brooks Range. The Lisburne is composed of highly porous carbonates, phosphatic shales, and argillaceous limestones. This formation is considered by the USGS to be the best potential reservoir in the entire area.

Pennsylvanian . . . Pennsylvanian rocks may be present in the lower part of the Sadlerochit sandstone but are not known presently with any degree of certainty.

Permian . . . The Sadlerochit sandstone overlies the Lisburne limestone and is known only from outcrops in the Canning River area. The formation is 300 to 600 ft. thick in this area but thickens and coarsens northward, where it becomes conglomeratic. It is largely marine and is composed mainly of fine-grained quartzitic sandstone.

Triassic . . . The Triassic period is represented by the Shublik formation which variously overlies the Sadlerochit formation, the Lisburne limestone and, on the Barrow "high," directly overlies the basement. On outcrop in the Southern Foothills belt, it is composed of interbedded, dense, bituminous limestone, dark gray chert, clay shale, oil shale, and siltstone. In the Barrow and Simpson wells, it is composed of fossiliferous, limonitic, oolitic limestone and glauconitic, calcareous siltstone. It is about 250 ft. thick on the Barrow "high" and about 300 ft. thick on the central Southern Foothills belt. It thickens both eastward and westward from the latter area, but Payne et al. believe it probably never exceeds 1,000 ft. The Shublik formation is entirely marine.

Jurassic . . . In the Canning River area, the Jurassic is represented by approximately 4,500 ft. of dark shale with siltstone interbeds that have been termed the Kingak shale. This section contains fossils of Lower, Middle, and Upper Jurassic age. In the central Southern Foothills province, an Upper Jurassic section with a maximum thickness of 1,500 ft. is composed of varicolored shale, sandstone, graywacke, and varicolored chert. About 800 ft. of Lower Jurassic glauconitic sandstone and shale is present in wells at Barrow and Simpson. The Jurassic is everywhere marine.

Cretaceous . . . The Lower Cretaceous is represented in ascending order by the Okpikruak and Torok formations and the lower parts of the Umiat and Chandler formations of Nanushuk group. The Umiat and Chandler formations are believed to be time equivalents. The Chandler is a fresh and brackish water facies of the marine Umiat formation. The lower parts of these two formations are, questionably, placed in the Lower Cretaceous.

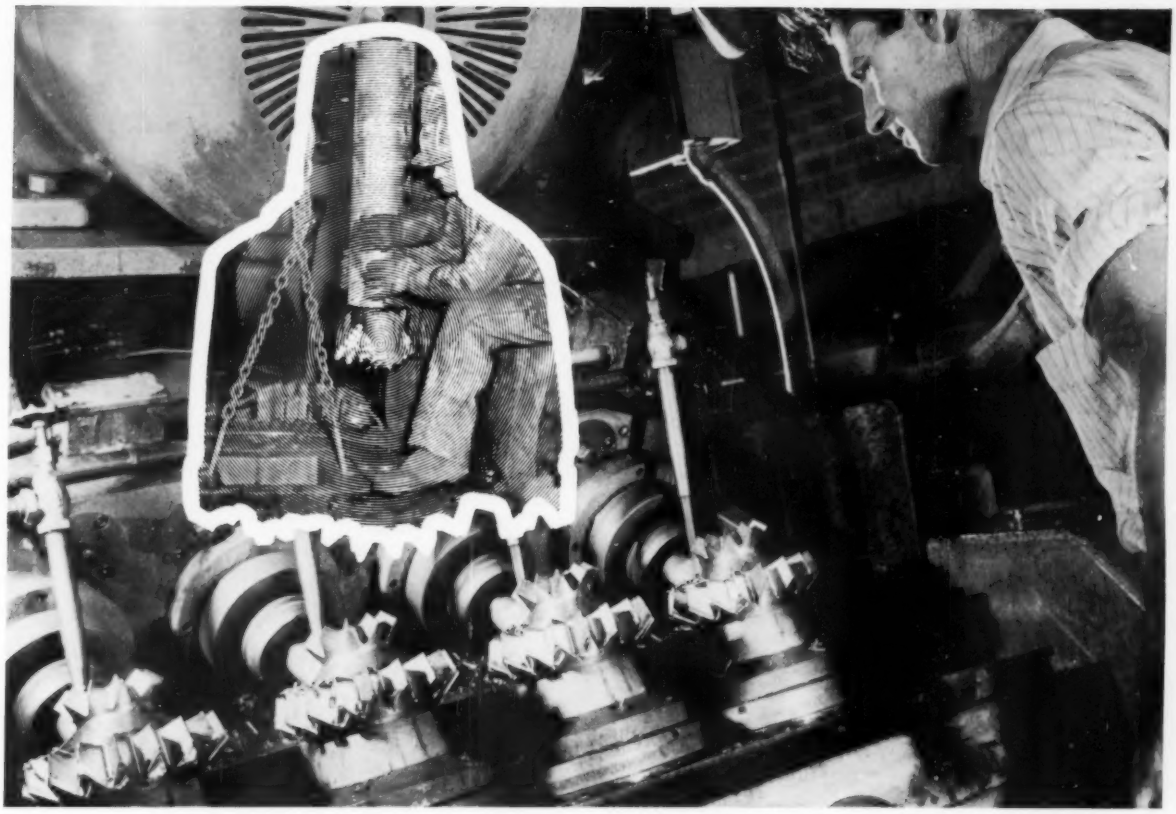
The Okpikruak formation consists of cylically bedded, marine, argillaceous sandstone, siltstone, and shale. The maximum observed thickness is about 1,850 ft. in the central Southern Foothills belt and varies from very thick to zero in the Barrow area.

The Torok formation overlies the Okpikruak formation and older formations in the Southern Foothills belt. It contains intraformational angular unconformities in that area and reaches a maximum thickness of 10,000 ft. in this area. The Oumalik test well penetrated only 7,000 ft. and the Torok thins to about 2,000 ft. on the Barrow "high." On the outcrop of its type section, the Torok formation is composed of a lower dark gray shale, siltstone, and graywacke member about 1,750 ft. thick. An upper member composed of conglomerate and graywacke is about 8,500 ft. thick.

Overlying the Torok formation is the Umiat formation of the Nanushuk group. The Umiat formation is the basal unit of the Nanushuk, but upward in section the marine Umiat formation grades toward the mountain front into the nonmarine Chandler formation. The Nanushuk group varies from about 5,500 ft. thickness in the hills south of Umiat to about 12,000 ft. in the Kokolik-Kukpowruk rivers region. It thins to 4,000 ft. in the subsurface of the Cape Simpson area. The graywackes, which are oil productive over wide areas of the north slope, are largely lenticular beds of the Chandler formation. The shales are placed in both the Umiat and Chandler formations according to their marine or nonmarine facies.

The Umiat formation has been subdivided by Payne et al. into a lower (Tuktu) member and an upper (Topogoruk) member. Two northward interfingering tongues of the Chandler have been termed the Hatbox tongue and the Niakogon tongue. The Niakogon is slightly younger than the Hatbox.

The Colville group overlies the Nanushuk group with local erosional unconformity. Like the Nanushuk group, the Colville group contains two formations—a nonmarine formation, the Prince Creek, and a marine formation, the Schrader Bluff. These beds grade laterally into each other.



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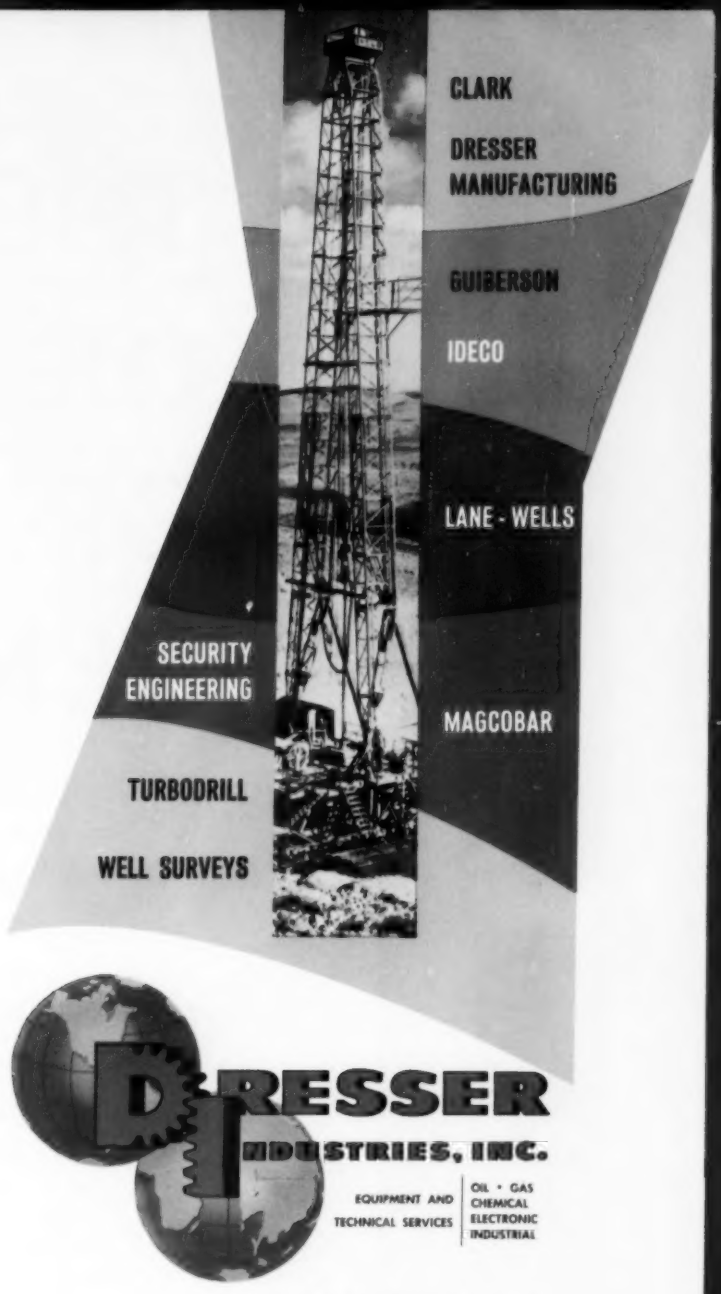

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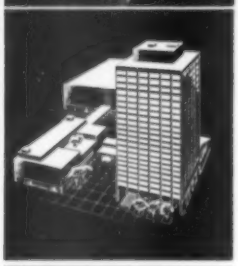

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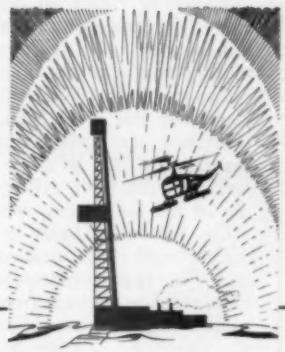

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5. Test the feasibility of air drilling. (This was done successfully in the shot-hole drilling at Shaviovik).
6. Sand-oil fracture all Cretaceous reservoirs.

The basal unit of the Colville group is the Seabee member of the Schrader Bluff formation. In the wells of Gubik gas field, the Seabee is a silty shale with no productive zones. At Umiat, however, the Seabee contains graywacke which in cores was saturated with oil in 10 Umiat. The upper part of the Seabee is a low-grade marine oil shale which may represent the source rock of the upper sands of the Schrader Bluff formation at Gubik.

The Prince Creek formation is predominantly coarse clastics interfingering northward with the Schrader Bluff formation.

Two large and relatively distinct tongues of this interfingering are, in ascending order, the Tuluvak tongue and Kogosukruk tongue. These tongues roughly correlate with the Tuluga and Sentinel Hill members, respectively, of the Schrader Bluff formation.

Tertiary . . . Overlying the Colville group with local erosional unconformity is the Sagavanirktok formation. This formation is known only in the Coastal Plain province and was little studied by the geologists of the NPR-4 exploration program. In the White Hills area, it is estimated to be 1,000 to 2,000 ft. thick and is mostly or entirely nonmarine. There it is composed of conglomerate, silty sandstone, and siltstone. Red, brown, and yellow beds alternate with nearly white strata.

Quaternary . . . The Gubik formation is composed of both marine and nonmarine unconsolidated gravels, sand, silt, and clay. It includes Pleistocene peat, ice, and oil residues at seeps. Thicknesses range from 0 to 150 ft.

Structure . . . Generally, the Arctic slope ranges in structural complexity from the nearly flat lying beds near the coast line on the north to the extremely complexly folded, faulted, and intruded sedimentary rocks of the Brooks Range province. The Foothills provinces are characterized by extremely lengthy anticlines. These characteristically are faulted and become more inclined toward a northern overturning as the mountain front is approached. Seismic work by the Navy indicates that the Cretaceous folds may be underlain by thrust faults of an earlier period of deformation.

Many separate closures are present along the axes of the anticlines. The critical feature of each closure appears to denote eastern plunge.

A regional basement "high" is present in the Barrow-Simpson area. Paleozoic beds are not present there unless the metamorphic rocks of the basement are of that age. The correlation appears to be unlikely to this writer.

Regional dips swing through an arc approaching 270° around the Umiat oil-field structure from northeast to southeast to southwest components of dip.

Petroleum Geology

Stratigraphic relationships of petroleum occurrence . . . The known oil and gas reservoirs of the Arctic slope are confined to the sandstones and graywackes of the Cretaceous Nanushuk and Colville groups. Due to the poor testing techniques used at Umiat, it is possible that some production comes from fractured shale reservoirs.

One of the principal objectives of the exploration of NPR-4 which was never realized, was the drilling of a Lisburne limestone test. The Lisburne has unique reservoir properties. It is associated with an excellent source rock at the top of the underlaying Noatak formation and the phosphatic shales within the formation. Known oil seeps from the Lisburne provided the basic data which fostered the desire for the test. Conversations by this writer with former members of the operating committee of the NPR-4 program indicate that such a test remains highly desirable.

Another zone offering an excellent petroleum potential is the Triassic oil shale-sandstone-fractured chert facies The only place the Triassic was penetrated was in Barrow-Simpson area wells. No structural traps nor proper lithofacies were present in this area. Seeps are known from the oil shale-sandstone-chert facies, and this facies should be present in the northern Foothills belt.

Other zones with less apparent potential offering possibilities of commercial production are the coarse clastic facies of the Tertiary-Sagavanirktok formation, the Lower Cretaceous-Torok formation, the sands of Jurassic-Kingak shale, the Permian-Sadlerochit formation, and the coarse clastics of the Mississippian - Noatak formation. None of these formations has been tested.

Structural relationships of petroleum occurrence . . . Of the nine oil and gas

fields discovered in the exploration of NPR-4, five are believed to be structurally controlled accumulations and four are considered stratigraphic traps.

Structural fields are Gubik, Meade, Oumalik, Square Lake, and Umiat. The best defined structurally of these, by combinations of seismic reflection, surface geologic definition, and subsurface mapping from well data, are Umiat and Gubik. These two fields by most standards are exceptionally large. Actually they are on relatively small separate closures of extremely long anticlines.

Gubik appears to be a simple east-west-trending structure plunging westward from an elongate structural "high" at approximately 150 ft. per mile, and eastward at about 100 ft. per mile. Total closure is unknown due to a lack of downplunge shooting at the western end of the structure. About 450 ft. of closure is proved. Yet it is possible that more than 600 ft. of closure may exist.

Structure contours from seismic data were drawn on Horizon "A" which appears to be an erosional unconformity with a slight angular discordance. Cores from 1 and 2 Gubik wells indicate that beds beneath Horizon "A" dip about 8° steeper than the beds above it.

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The Umiat anticline has been mapped a distance of 100 miles or more. A few miles east of NPR-4 the structure is masked beneath the sands and gravels of the Quaternary Gubik formation. It reappears eastward where it is known as the Kuparuk anticline.

The structural closure in which the reservoirs of Umiat oil field are situated is approximately 8 miles long and 2 miles wide. The structure is faulted by thrusting with the south side overriding the north. Two wells at Umiat penetrated this fault, 1 and 8 Umiat. Projecting the surface expression of the fault to the levels at which the wells cut the fault indicates that the dip of the fault plane increases from about 33° in 8 Umiat to about 75° in 1 Umiat. This westward steepening of the fault plane appears to coincide with the distance from the structurally highest part of the field and decreasing stratigraphic throw. There is about 700 ft. of stratigraphic throw at the crest of the field.

All reservoirs are sealed by the fault. These in ascending order include the lower Umiat, upper Umiat, and New Umiat. Fluid or gas communication does not appear to exist across the fault. Subsurface geologic data and seismic work indicate about 750 ft. of closure on Umiat field.

Reservoir characteristics . . . The reservoirs of Umiat and Gubik fields are Cretaceous graywackes and subgraywackes which are composed primarily of quartz, metamorphic rock fragments, micas, and montmorillonite clay. They range in grain size from very coarse to very fine, and the grains are angular to subrounded. The sorting is usually poor and all productive sands contain significant amounts of montmorillonite clay.

Montmorillonite clay has the property of swelling to as much as 90 times its original volume when placed in contact with water less saline or less acid than fluids of its original environment. This fact was not fully appreciated during the early phases of exploration of NPR-4 and fresh-water-base mud was used in drilling operations. It is now known that the fresh-water-base mud caused the clays to swell 1 and 2 Umiat wells to such an extent that the reservoirs would not produce oil. These wells were abandoned as dry holes and the Umiat structure was condemned as an important oil producer until 1950 when 4 Umiat (formerly 1 Ruby) was drilled with cable tools using highly saline drilling fluid. This technique and later use of oil-base drilling mud proved conclusively that the Umiat reservoirs are most adversely affected by con-

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tact with fresh water, but will produce oil at acceptable rates when properly completed.

Production tests of the reservoirs were undertaken for periods as long as 90 days, but the capacity of the pump used in these tests was 300 bbl. per day. In every significant test the capacity of the pump was less than the capacity of the well. No decline was found in any production test.

Occasionally a well would flow upon completion at rates as high as 400 bbl. per day for short periods. Ice bridges forming in the tubing would prevent any lengthy flowing tests and ice in the tubing occasionally hampered pumping tests. This latter problem was eventually solved by wrapping a strand of special alloy copper wire around the tubing and passing a trickle charge of electricity through the wire. This kept tubing temperatures at 32°-33° F., prevented the formation of ice in the tubing, and at the same time, did not raise the temperature of the permafrost zone sufficiently to cause melting.

Most of the reservoirs at Umiat are within the permafrost zone, and this accounts largely for the production problems and the exceptionally conservative reserve figures ordinarily attributed to Umiat (70,000,000 bbl. primary production by USGS). Umiat reserves can be legitimately calculated in excess of 200,000,000 bbl., but since no other oil field in the world produces from a permafrost zone, it is not known what effect the permafrost would have on ultimate recoveries. Production tests at Umiat are not considered conclusive on this point. Available data would make it appear that the interstitial ice particles in the reservoir would tend to reduce the permeabilities and porosities measured in the laboratory core tests (core measurements ranged from zero to several darcies permeability and averaged about 17% porosity). Since these measurements were made at room temperature, the ice would occupy about 9% more space than the contained connate water. At the same time, the ice would tend to reduce permeabilities and restrict the size of the passage through which the oil must flow in the reservoir.

It was considered that water flooding would be impractical because the low temperatures of the permafrost zone would freeze the water to ice. Secondary-recovery efforts would therefore be limited to a pressure-maintenance program by gas reinjection.

Recent technical advances in the fields of hydraulic fracturing and LPG sweep-type secondary-recovery programs indicate that productive capacities per well could be substantially increased (trebling of productive capacity seems quite reasonable. A secondary-recovery program of greater efficiency than water flooding could raise ultimate recovery figures to 200,000,000 bbl.

Despite the adverse effects of fresh water coming in contact with the swelling clays in the reservoir graywackes, Gubik field was drilled using fresh-water-base mud, and gas was found in four reservoirs ranging from the lower part of the Topagoruk member of the Umiat formation to the Tuluga member of the Schrader Bluff formation. Due to the combination of fresh-water mud and poor drill-stem-testing techniques (excessive intervals) it is considered that at least five other reservoirs may have been overlooked.

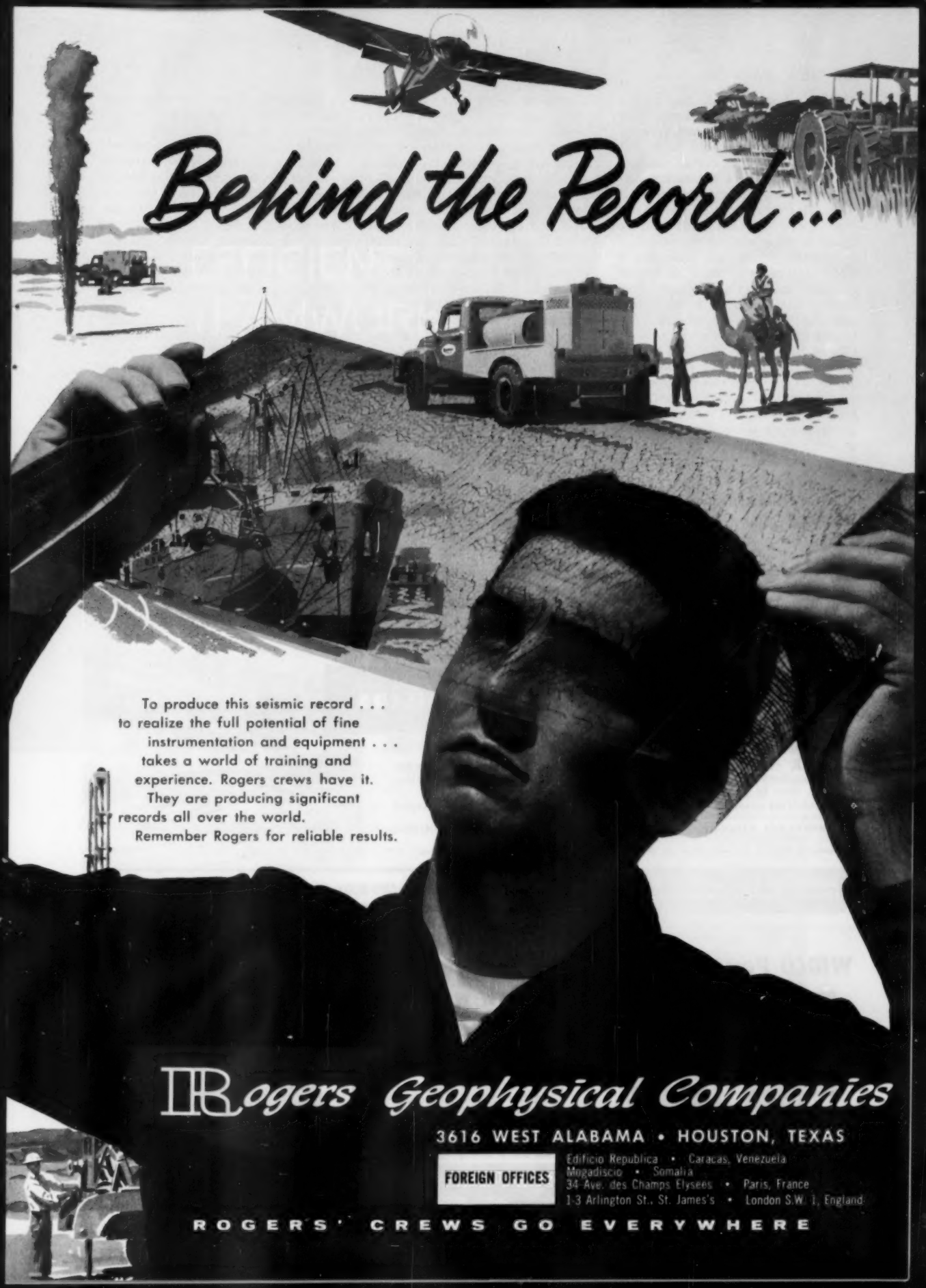
Core analyses of the reservoir graywackes at Gubik indicate a porosity range from 10 to 22% and a permeability range of from zero to 3.78 darcies.

Generally the reservoirs at Gubik appear to be better than those at Umiat, and all reservoirs at Gubik are below the base of the permafrost zone. The problems of permafrost-zone reservoirs which exist at Umiat are not extant at Gubik. As previously stated, the drilling, testing, and completion techniques by the Navy do not furnish adequate data for a proper reservoir analysis. It is reasonably certain that the reservoirs in both Umiat and Gubik are considerably better than is indicated by present data.

Analysis of discovered hydrocarbons . . . Early sampling methods were uncertain and a wide variation exists between the laboratory analysis of the crude from 1 Umiat and other Umiat wells. Thus the precise character of Umiat crude is as yet to be determined. In general, the crude is green or yellow-green, slightly paraffinic, 36.5° API, with a low sulfur content (less than .01% and is unusual in having an exceptionally high content of naphthenes and aromatics.

Two samples taken from cores in 3 Umiat well had the following cuts: (1.) 16% aviation-gasoline base stock, 40% motor gasoline, 32% (cetane) diesel fuel with —10° F. pour point; (2.) 65% jet fuel, and 20% lubricating stock with —10° F. pour point. Pour points of the samples were —10° and —25° F.

Crude from 1 Umiat was lower in gasoline content and higher in paraffin than other samples from the Umiat wells. This sample, however, was obtained by collecting it from a small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pool of oil standing on top of the ce in the hole of 1 Umiat 1 year after he ho e had been abandoned. It seems ike y the sample would have lost uch of its volatiles during the pre- ious summer with a consequent per- centage increase in the heavier frac- tions. This would account for the dis- s mil rities of 1 Umiat crude from the udes of other wells in the field.

Analyses of the gas from the 1 Gubik well made by the U. S. Bureau of Mines indicates a range of values from 97.05% methane in the shallow sands to 94.7% in the sand at 3,500 ft. and 92.8% in the sand at 3,700 ft. Ethane ranges from 1.25% in the upper sands to nearly 5% in the lower sands. Noncombustibles (nitrogen) do not exceed 0.13% in any known reservoir. The increasing wetness of the gas with depth is significant in that it indicates the possibility of an oil ring low on the flanks of the Gubik structure.

Other Structures

Petroleum potential . . . In assessing the petroleum potential of any area, primary consideration must be given to the presence of petroleum source rocks, and of traps sufficient to localize commercial accumulations of petroleum within the reservoir rocks.

Petroleum source rocks are known to be present in all ages from Lower Mississippian through Upper Cretaceous. Coarsely porous reservoir rocks are known to be present in association with these source rocks in all of these same ages. The surface and photogeologic work done by the USGS and the seismic work done by United Geophysical Corp. abundantly demonstrate the presence of some of the most lengthy anticlines in the entire world. Separate closures by plunge reversal and faulting along these anticlines are also clearly demonstrated. The presence of adequate traps is beyond question.

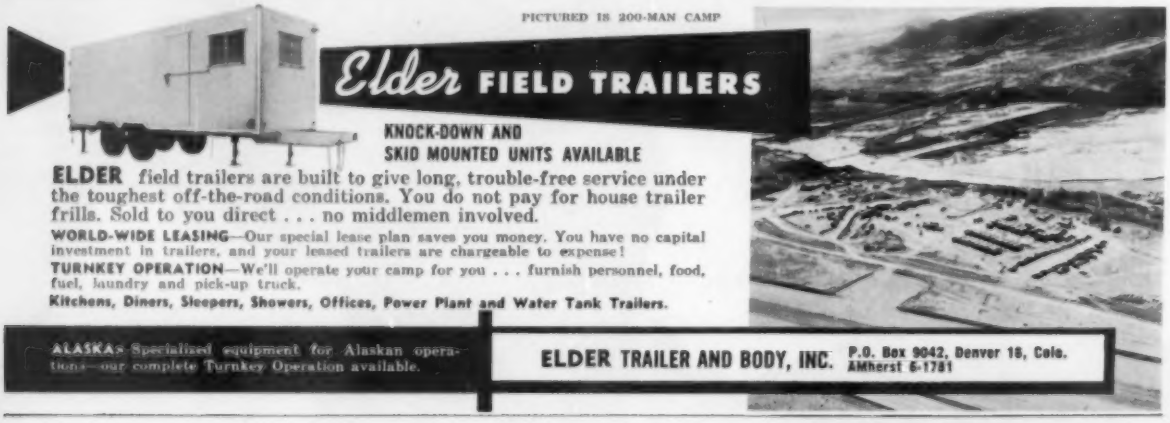
The basic requirement of source rocks, reservoir rocks, and traps is obviously established in Umiat and Gubik fields. Projecting this threefold relationship into undrilled areas is primarily a problem of facies mapping combined with trap mapping. Payne et al. (1951) accomplished the facies mapping for the Colville and Nanushuk groups and copies of their maps are reproduced as Fig. 4. The "inshore facies" in each map is considered to be the favorable belt for petroleum accumulation. Traps located in these belts can be expected to be productive, and the structural-trap analysis is given below in some detail.

Production from rocks older than the Nanushuk group has not been established on the Arctic slope. The likelihood of such production appears good as has previously been pointed out, but it is nevertheless true that the proper combination of facies and traps could be at rather great drilling depths. The present merits of the Arctic slope must, for economic reasons, rest with its Cretaceous potential.

A structure-by-structure evaluation of the 18 anticlines recently opened to lease by the public follows:

Big Bend . . . The Big Bend anticline is an extremely lengthy structure with Nanushuk group sediments exposed throughout its length. A field party led by R. L. Detterman in 1952 found this anticline to be structurally complex. A plunge reversal east of the Chandler River results in closure of 200-500 ft.

The facies maps indicate that the western part of the anticline is underlain by "inshore facies" of the upper Tuktu; the eastern part by "inshore facies" of the upper Topagoruk, with favorable facies of the lower Topagoruk over most of its length. The Grandstand test well was drilled subsequent to the preparation of the facies maps and data from this test indicate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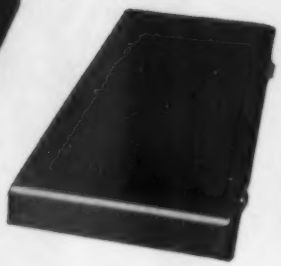

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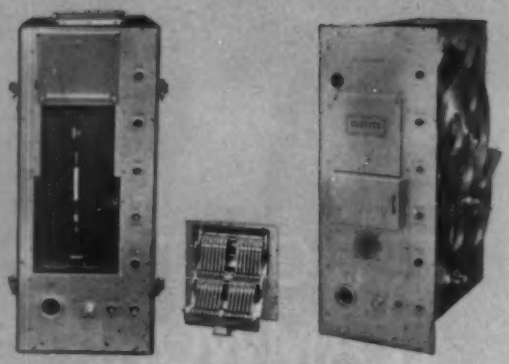

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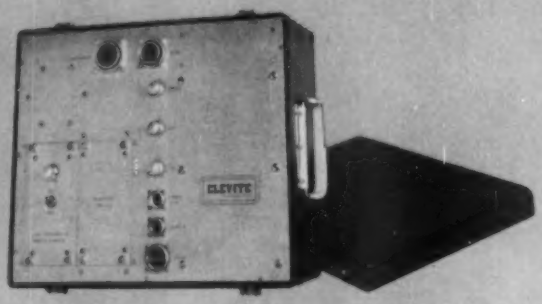

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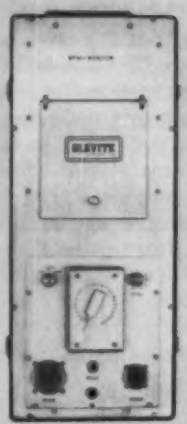

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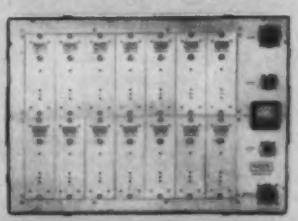

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that some modifications of the facies maps are probably necessary in this immediate area. It is unique in that it is the only area wherein revision of the facies maps is indicated by subsequent investigations. Although this structure retains some potential, Reed (1958) feels that the Grandstand test lessened its attractiveness.

Burnside . . . The Burnside anticline (unofficially named after the writer) is a relatively small anticline that received no detailed investigations by the NPR-4 program. Surface exposures to the south indicate the possible presence of several potentially good sands in the subsurface, but lack of information makes this structure difficult to evaluate at the present time. The facies maps do not cover the area of this anticline.

Divide Creek . . . The Divide Creek anticline is a broad, gently dipping structure, which was mapped mostly by photogeology from component dips. The area is underlain by the Tertiary-Sagavanirktok formation and is largely covered by a thin veneer of Gubik sediments. The stream pattern from which the structure takes its name indicates a relatively recent structural movement causing a drainage divide. The creek flowing down the crest of this long anticline is typical of this situation where a single hard bed has withstood headway erosion by the creeks flowing down the flanks of the structure.

The facies maps indicate favorable possibilities for production from the Sentinel Hill member. The Tertiary was little studied, and it is now known that Tertiary petroleum potentials are present. It represents a somewhat slim possibility although the pre-Cretaceous potential appears favorable to this writer, and for further discussion see North Shaviovik, which follows.

East Gubik . . . The East Gubik anticline is considered to be that portion of the Gubik anticline lying east of the Anaktuvuk River. The Gubik anticline, like most anticlines on the Arctic slope, is extraordinarily long. Production was established by the Navy in 1 and 2 Gubik wells. The anticline is masked by Quaternary-Gubik sediments from the east bank of the Colville River to as far east as Range 6 East. The crest of the structure is exposed in that area for a mile or so and disappears again beneath Gubik sediments. It reappears in the western part of Range 7 East for a distance of about 1½ miles. At this point it again disappears beneath the Gubik gravels associated with the Anaktuvuk and Itkillik rivers. The structure is not seen again unless as one of the anticlines east of the large reentrant covered by the Tertiary-Sagavanirktok formation (see Payne et al.) eastern counterpart. It is possible that the intermittent reappearances of the crest of the structure also correspond with individual closures on the anticline.

The facies maps indicate that the upper part of the Topagoruk member, the Tuluga member, and the Sentinel Hill member should be productive. The Sentinel Hill member has been removed from the crest of the structure by erosion. The first two zones are productive at Gubik.

East Umiat . . . The East Umiat anticline is herein considered to be that portion of the Umiat anticline lying east of the Colville River and west of the Anaktuvuk River. Sediments of the surface in this area were tentatively placed in Zone "H" in the terminology used in the actual mapping of the Nanushuk and Colville groups. Zone "H" sediments at the crest of the anticline would place the graywackes which are productive at Umiat well below the case of the permafrost zone and thereby eliminate most of the production, reserves calculations, and

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secondary-recovery problems encountered at Umiat.

The facies maps indicate that the lower Topagoruk, upper Topagoruk, and Tuluga members should be productive here. Part or all of the Tuluga would be within the permafrost zone in this area. The first two zones are productive at Umiat, where the Tuluga member has been eroded from the crest of the structure.

Fossil Creek . . . The Fossil Creek anticline lies just across the Prince Creek syncline to the south of the Umiat anticline. Sediments at the surface here are slightly older (Zone "C" at Fossil Creek, Zone "D" at Umiat) than the sediments exposed at the crest of Umiat. It is likely that the upper Umiat pay will be missing (by erosion) here and the lower Umiat pay will certainly be in the permafrost zone. On the other hand, sands older than the lower Umiat pay should be present here and some could be below the base of the permafrost.

The facies maps indicate that the lower Topagoruk, upper Topagoruk, Tuluga members, and possibly the upper part of the Tuktu member should be productive here. The Tuluga and upper Topagoruk have been removed by erosion, however, so that the lower Topagoruk and upper Tuktu offer the best potential.

Grandstand . . . The Grandstand anticline, like Big Bend, is an extremely lengthy complexly folded and faulted structure with Nanushuk group sediments exposed throughout its length at the crest. A test of this structure was drilled on the left bank of the Chandler River where it crosses the axis of the anticline. The hole was carried to 3,939 ft. without encountering the thick sands that had been noted on the outcrop south of the Hawk anticline. The test found steeply dipping beds at about 3,500 ft., and it is thought that a thrust fault was penetrated at that depth. The Grandstand test cannot be considered to have condemned this structure, but it does indicate that the prime potential may be limited to the deeper formations.

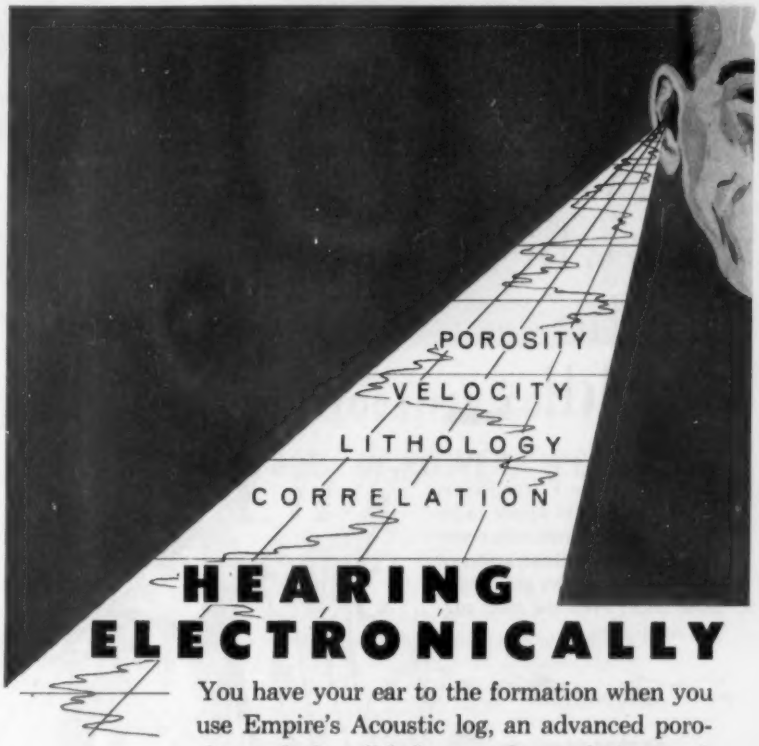
The facies maps indicate that in its western part, the lower part of the Tuktu member should be favorable. The upper part of the Tuktu member through its length and the lower part of the Topagoruk member in its western part may be favorable for oil accumulation.

Hawk . . . The Hawk anticline lies south of Grandstand. Zone "D" sediments are present at the surface but due to the distance between Umiat-Gubik areas and this area the facies relationships previously discussed probably do not apply.

The hole drilled on the Grandstand anticline (shown on map) was expected to encounter sand seen on outcrop south of the Hawk anticline. They were anticipated in the upper 2,000 ft. of the well but were not found. The Hawk anticline has plunge reversal, and field work by the Geological Survey indicates a closure of about 1,000 ft.

Facies maps do not extend into the Hawk area. It seems possible that the coarse clastic facies of the Torok formation could be present here and this formation may be encountered in a 6,000-ft. test. Reed (1958) considered that the sands noted south of the Hawk and expected in the Grandstand test were probably present, and the Grandstand test did not diminish the prospects at Hawk.

Kemek . . . The Kemek anticline was recommended by the Navy for investigation as a possible structure for a pre-Cretaceous test. The tight folding of the area as compared with the Shaviovik area makes it appear that the structure map may be sep-



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arated from the Arctic basin proper by a thrust zone. The Kemek and associated structures are probably on the upper plate of the thrust. The facies maps do not cover the area of this anticline.

Killik Bend . . . The Killik Bend anticline is a long sinuous structure with a general east-west trend. It curves sharply northeastward where the structure lies within the area open to leasing. Nanushuk group sediments are exposed at the surface along the crest of structure. The structure was little studied other than mapping by photogeology. Closures are not known to exist within the leasing area. The facies maps indicate that the upper Tuktu, lower Topagoruk, and upper Topagoruk members should be productive in this area.

Kuparuk . . . The Kuparuk anticline is an east-west trending structure which seismic work has shown to be an eastern extension of the Umiat anticline. Due to the poor exposures in the area between the Anaktuvuk and Kuparuk rivers, zones were not mapped in the area. It is known that the rocks at the surface crest are somewhat younger than those at the surface at Umiat.

The facies maps indicate that the upper Topagoruk, Tuluga, and Sentinel Hill members should be productive in this area. It is not certain whether the Sentinel Hill member has been removed by erosion, but seismic records indicate many more and deeper reflecting horizons in the area. This increased number of reflections suggests a thicker sand section.

Kyak Mountain . . . The Kyak Mountain anticline is a long east-west trending arcuate structure. Like adjacent structures, it received no real investigations during the exploration of NPR-4. It may be underlain by the same sands discussed as potential producers at the Hawk and Burnside anticlines. Closures are not known, but the length of the structure indicates closures are possible. Absence of data makes evaluation difficult. The facies maps do not cover the area of this anticline.

Little Twist . . . Little Twist anticline is located just south of Outpost Mountain syncline which separates it from the Fossil Creek anticline. Faults transverse to the axis of the Little Twist anticline divide it into three segments. The central segment appears to have closure at each end provided by faults. The eastern segment seems to trend into the eastern end of the Ninuluk Creek syncline and should have downplunge closure. Little Twist may be a fork of Big Bend anticline. Eastern closure of the eastern segment is then a problem connected with Big Bend. A few miles east of the projected possible intersection of Little Twist and Big Bend anticlines, eastern plunge is present on Big Bend which should give eastern closure to the eastern segment of Little Twist.

The facies maps show that the upper Tuktu, lower Topagoruk, upper Topagoruk, and possibly the Tuluga members should be productive in this area. Zone "E" is present at the crest of this structure, which shows that the Tuluga member has been eroded from the crest of the structure.

North Shaviovik . . . The North Shaviovik structure is on the Arctic Coastal Plain and is in a region of extremely low dips. The structure is broad and was mapped entirely by photogeology mostly from component dips.

Tertiary - Sagavanirktok and Cretaceous - Colville group sediments are present at the crest of the structure. Nanushuk group sediments are probably much too fine grained to comprise reservoir rocks in the area, but the Sentinel Hill member of the Schrader Bluff formation should be

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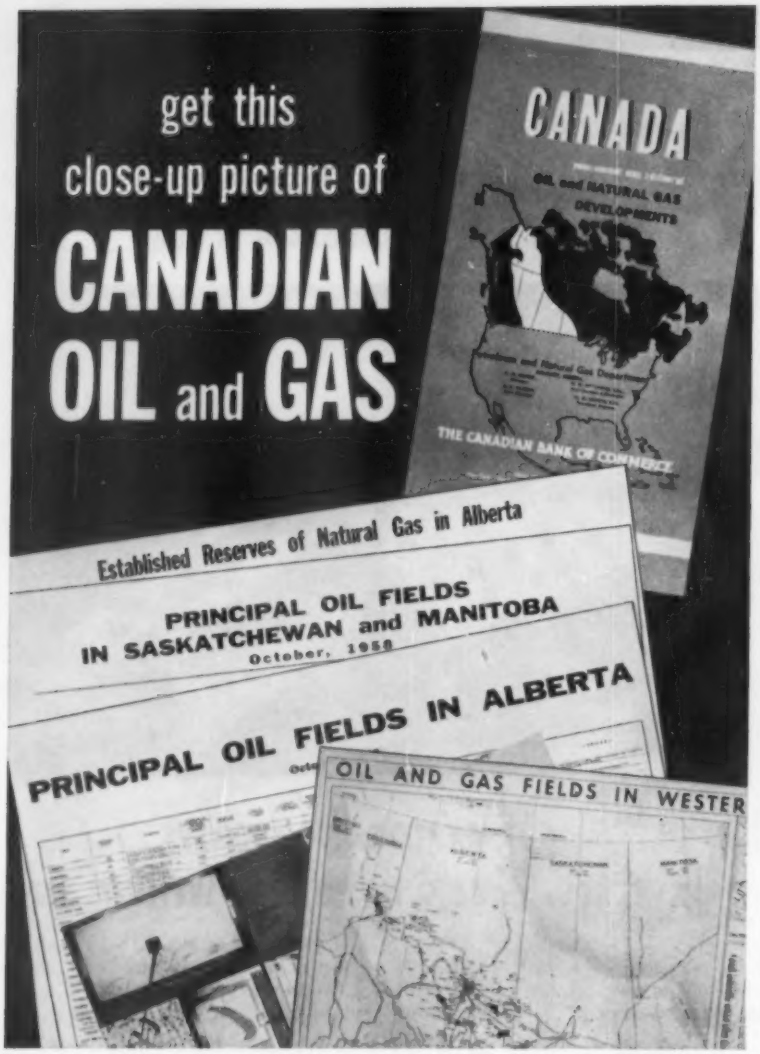

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sufficiently coarse. Projecting the facies map trends into the area indicates that this view is probably held by Payne and others.

The Tertiary appears to be too thin in this area to present any real potential; the writer feels that pre-Cretaceous possibilities at reasonably shallow depths are excellent. While the Barrow "high" had no pre-Mesozoic sediments, this area is far to the east of the high and the presence of Paleozoic sedimentary rocks under a relatively thin Mesozoic cover seems a good possibility. The writer's experience with other highs similar to Barrow, i.e., the Llano uplift, Black Hills uplift, and the Cincinnati arch, etc., where similar relationships are known, is the primary factor behind this reasoning.

Schrader . . . The Schrader anticline may be an eastern extension of the Fossil Creek anticline. Surface work indicates that the area between the two structures is complicated by faults. The Schrader anticline is separated from the eastern part of the Umiat anticline by the Prince Creek syncline, and the Fossil Creek structure is similarly situated westward.

The Schrader anticline probably has fault closure to the west and possibly plunge closure as well (a small syncline to the south trends toward the western end of the anticline). Two seismic profiles indicate 400 ft. of eastern plunge east of the Chandler River (Reed, 1958).

The facies maps indicate that the lower Topagoruk, upper Topagoruk, and Tuluga members should be productive in this area. Zone "G" sediments are present at the crest of the anticline (the south flank of the structure seems to be complicated by faulting), and all three units should be present in the subsurface.

Shale Wall . . . The Shale Wall anticline lies between the Big Bend and Grandstand anticlines in the eastern part of the area largely between the Nanushuk and Itkillik rivers. The western end of the structure is intersected by a fault zone which appears to be on the southwest side. The eastern end of the structure disappears beneath the Gubik gravels associated with the old terrances of the Itkillik River. No seismic work was done on the Shale Wall anticline, and whether structural closure exists is questionable, but the length of the structure suggests that closure along its axis is likely.

The facies maps indicate that the upper Tuktu, lower Topagoruk, and upper Topagoruk members should be

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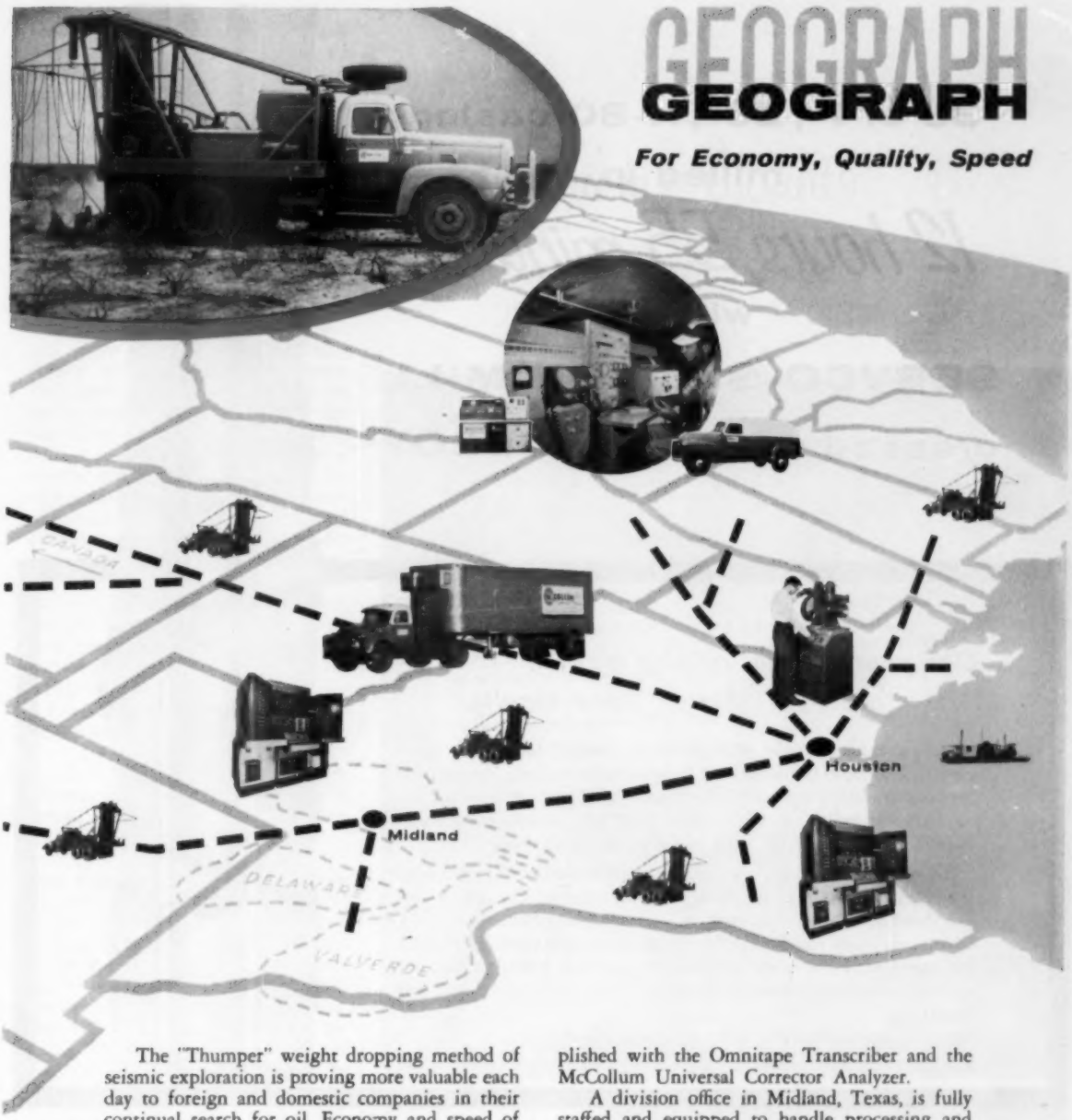

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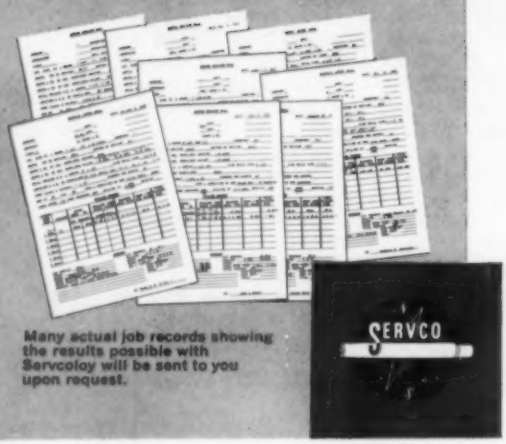

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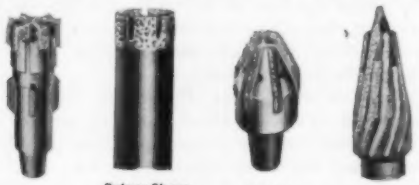

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productive in this area, but the modifications made necessary by the Grandstand test may also apply in this area.

Shaviovik . . . The Shaviovik anticline is the easternmost structure submitted, and the Cretaceous facies maps do not extend into this area. Less information is available for this area than the western area, but the report by a field party led by A. Samuel Kelley in 1952 indicates that the minimum closure on the structure is 900 ft.

Seismic work on the structure was just begun in 1953 when the entire NPR-4 program was closed down. This shooting was continued, but the use of velocities known from the distant Umiat-Gubik area and the use of thicknesses of section measured at equally distant areas renders the interpretations of depth to the Paleozoic section somewhat doubtful. A reinterpretation of the records (available on microfilm) seems advisable, especially in view of the fact that after 10 years of exploration, the Navy and USGS considered it to be the best pre-Cretaceous prospect on the Arctic slope and had received approval for a 10,000-ft. test on it.

The Cretaceous potentials are not well known and the facies maps do not extend into this area. If projecting their trends eastward is possible without substantial error, then the Tuluga and Sentinel Hill members should be productive at Shaviovik.

West Kuparuk . . . The name West Kuparuk was given to that segment of the crest of the Umiat-Kuparuk anticline which is exposed just east of the confluence of the Anaktuvuk and Nanushuk rivers. Nanushuk group sediments are exposed at the surface. The facies maps indicate that the upper Topagoruk and possibly the lower Topagoruk members should be productive here.

General Operating Conditions

Misconceptions about the Arctic are so commonly held that it is considered appropriate to quote Reed on some of the more salient features regarding operations in the area.

Climate . . . Regarding climate, Reed says: "The climate of Naval Petroleum Reserve No. 4 is cold, but outdoor activities can be performed throughout the year, except for short periods of high wind or storm, provided a person is in good physical condition, well fed, and supplied with sufficient appropriate clothing. In fact, the temperature cutoff point for effective operation is frequently the effect of low temperature on equipment rather than on humans. Much has been

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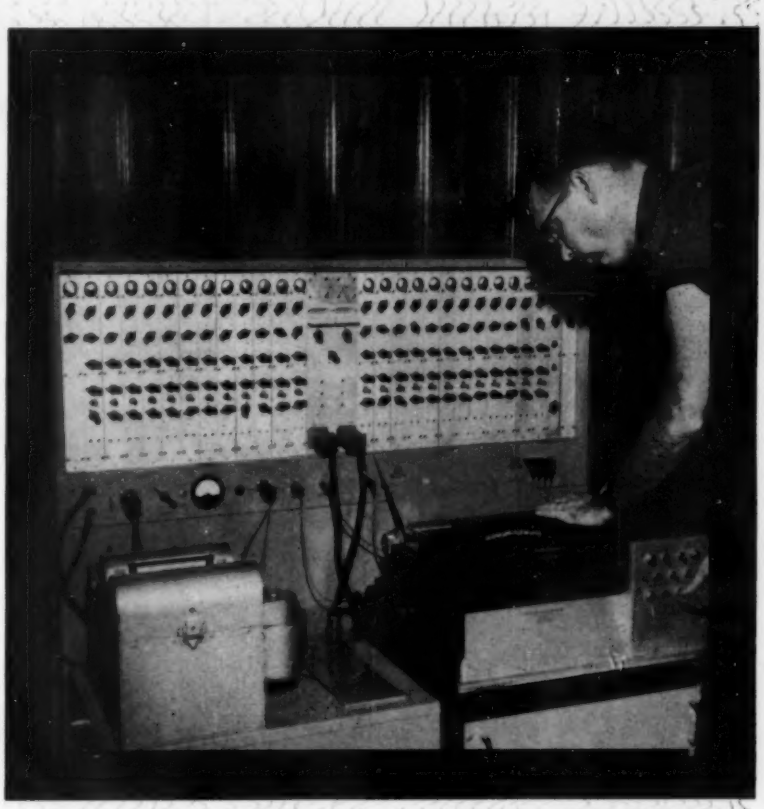

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learned about winterizing equipment for use in very cold weather."

Temperature . . . Concerning temperatures, Reed says: "The maximum range of temperature may commonly be about 130° F. along the Arctic Coast. Precise data are not available except for a very few localities such as at Barrow . . . The highest temperature in summer along the coast often is about the same number of degrees above 0° F. as the lowest temperature in winter is below 0° F.; that is roughly 65° F. The summers are short, however, and it is not unusual for the temperature to rise above the freezing point only occasionally from October through May. The temperature is likely to drop below freezing at times during even the summer months."

Precipitation . . . Deep snow is not a problem due to the great aridity of the area north of the Brooks Range. At Barrow, the mean annual precipitation recorded by the Weather Bureau is 4½ in., and much of this falls as snow. The 1945 Barrow records show 28.6 in. of snow with a total precipitation of 3.05 in. Observations indicate about 3 to 4 ft. of snowfall occurs in the mountains of the Brooks Range.

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The USGS Open File contains at least the following, many of which were extensively drawn on throughout this report: 12 photogeology maps, 43 preliminary reports, 43 special reports, 46 regular reports, 67 well-data reports, 104 preliminary photogeology maps, 151 geological investigation reports, and 464 seismic cross-sections.

Forthcoming USGS Professional Papers, currently in the Government Printing Office, include the following:

305e, Test Wells, Grandstand Area.

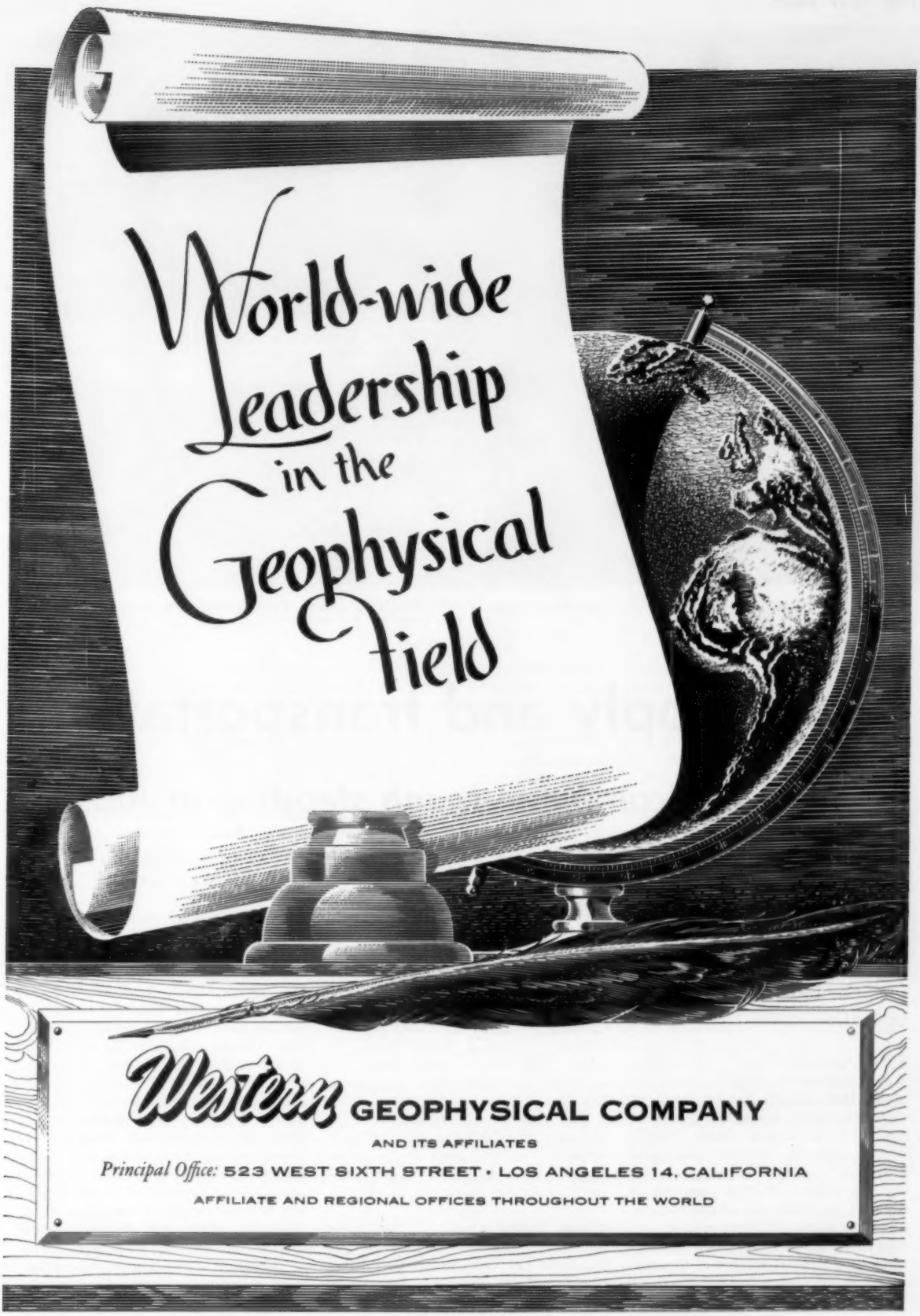
305f, Test Wells, Meade and Kaolak Areas.

305g, Test Wells, Titaluk and Knifeblade Areas.

305h, Test Wells, Square Lake, Wolf Creek Areas.

305i, Test Wells, Sentinel Hill, Fish Creek Areas.

305j, Test Wells, Simpson Area.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Supply and transportation

can mean tough sledding in Alaska

Shipping comprises a great portion of over-all exploration expense. Preplanning joint ventures which use existing seasonal transportation facilities can sharply reduce operation costs.

BY TED C. MATHEWS AND JAMES W. DALTON
Exploraton Services, Inc.
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APPROXIMATELY 150 million acres, comprising roughly one-third of the land area of Alaska, has been classified in an open file report of the U. S. Geological Survey (1957) in the form of "possible petroleum provinces." Since 1953, the year marking the advent of "new interest in Alaska" by major oil companies, exploratory work including seismic surveys and drilling has been concentrated (dollar-basis volume of expenditures) in provinces located south of the Alaska Range, and more particularly in the Cook Inlet Tertiary and Mesozoic provinces, and in the Gulf of Alaska Tertiary province which have a combined area of about 17 million acres.

Concentration of exploratory efforts . . . Concentration of efforts in these localities may be regarded as normal. Chances for discovery based on preliminary geological investigations favored these areas where land was available and exploratory costs were less than in more remote areas.

This can be directly attributed to existence of established transportation systems. Further aspects of the future markets are enhanced by their proximity to ice-free navigable water.

Present leasing trends . . . Successful exploratory results highlighted by Richfield Oil Corp.'s Swanson River discovery have given rise to a vigorous land play. Applications for federal leases on 34 million acres of Alaskan land have been filed since July 1, 1957. (The total Alaskan acreage leased as of this date was about 3 million acres.) During the interval of July 1, 1957, to January 30, 1959, applications have been filed on about 22 million acres situated north of the Alaska Range and the apex of its westward extension, the Alaska Peninsula. Department of the Interior orders effective September 1958 restored to the public domain 20 million acres of formerly reserved (PLO No. 82) land on the Arctic slope. This stimulated leasing and exploratory activity in an area where a great store of geological knowledge on one of the most extensive sedimentary basins on the North American Continent has

CONTRACTOR'S CAMP at Point Barrow, Alaska. This was supply base for NPR-4 and later for DEWline operations.

been accumulated as a result of the U. S. Navy's 60-million-dollar exploratory program 1944-1953.

Alaska's Sen. E. L. Bartlett has introduced a bill (S. 434, January 17, 1959) proposing restoration of lands comprising Naval Petroleum Reserve No. 4 in the Arctic coastal region of Alaska to the public domain. Passage of this bill, reported favorably viewed by the Navy, would open the entire Arctic slope (about 44 million acres) to development under the mineral leasing laws.

New areas of interest . . . In keeping with these circumstances it is expected that exploratory activity, heretofore concentrated in southern Alaska, will extend into the state's central and northern regions. On the basis of known geology, leasing activity, and potential marketability, the more promising areas in these regions are considered to include: the Nushagak basin (lease applications filed on about 8,000,000 acres); the Bethel basin (lease applications filed on about 3,500,000 acres); Kandik Mesozoic and Paleozoic province (lease applications filed on about 4,500,000 acres); Yukon - Koyukuk province (lease applications filed on about 4,600,000 acres); and the Arctic Foothills provinces (lease applications filed on about 1,800,000 acres. Other "petroleum provinces" located in central, northern and northwestern Alaska considered worthy of exploratory activity include the following areas: Norton basin; Selawik basin; Holitna basin; Lower, Upper, and Middle Tanana basins; Yukon Flats basin; Innoko basin; and the Kobuk Cretaceous province.

Alaskan supply situation . . . The new areas of interest, lacking an orthodox transportation system distant from supply centers, present unusual logistics problems. Unusual methods will be required to solve some of these problems in certain locales. Since the cost of exploration is greatly influenced by the expense of moving into and sustaining operations under prevailing conditions, expert planning is essential for efficient operation. Time is more important in industrial logistics than in the military because cost is usually the over-all ruling factor. Time can be bought (and the military in Alaska was often forced to do so) if it becomes imperative.

In scheduling operations in new areas of interest it is economically essential to consider all aspects of Alaska supply and transport relative to delivery schedules at operating sites.

Origin of supplies . . . Presently, Alaska lacks the capacity for completely outfitting large-scale exploratory ventures. However, stocks of food, hardware, powder, fuel, construction cement, building materials, and the usual consumer goods are available within the state. Construction equipment of proper types and sizes is also available at reasonable rental rates. Radio communications within the state and external commercial communications with the rest of the U.S. exist in Alaska.

Major supply companies have watched local petroleum activities for the past several years. They propose moving into the state when the scale of operations becomes sufficient to support their business. Drilling rigs, mud, cement, chemicals, tubular goods, oil-field expendable items, and technical equipment required in the near future will probably be provided mostly from the continental U.S.

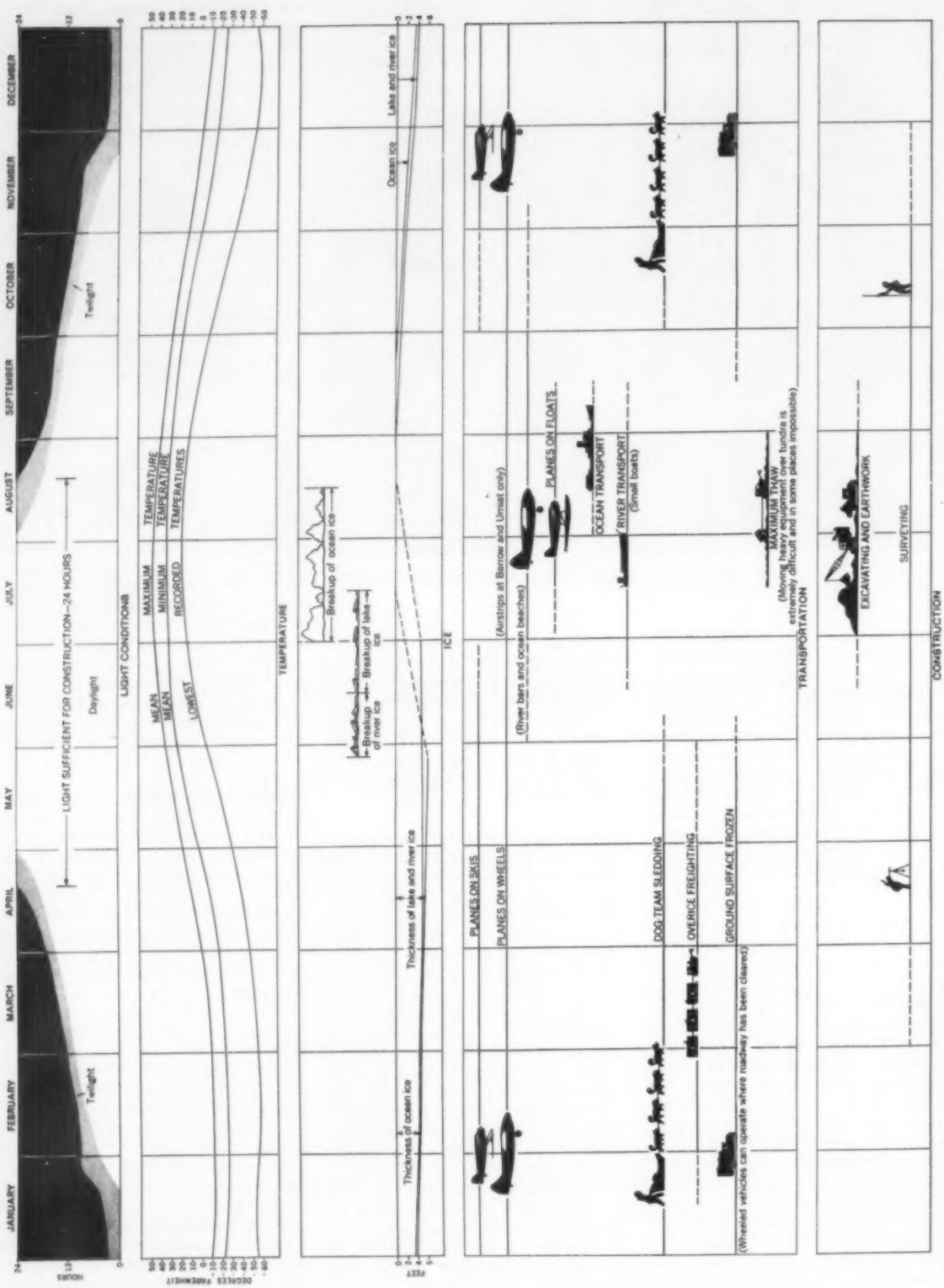
Transportation

External transportation . . . The conventional mode of shipment of supplies between the continental U.S. and Alaska is by ship and barge. Ship and tug barge carriers with published tariffs include among others: The Alaska Steamship Co., Pier 42, Seattle; Alaska Freight Lines, Seattle; and Alaska Barge & Transport, Anchorage, Alaska. They operate mainly out of the Pacific Northwest to various Alaskan ports on a scheduled basis. The Alaska Highway provides an all-season route to the continental U.S. via the Canadian Highway system, but has not proved competitive to date as a supply route.

Internal transportation . . . The Alaska Railroad, built and operated by the U.S. Government, provides a supply route from the ice-free ports of Seward and Whittier on the Gulf of Alaska into the interior, terminating at Fairbanks. Principal distribution points enroute are Anchorage, Palmer in the Matanuska Valley, and Nenana on the navigable Yukon-Tanana river system.

The Yukon & White Pass Railroad, a privately owned narrow-gage road, operates between Skagway in southeastern Alaska and Whitehorse located on the Alaska Highway in Yukon Territory. Whitehorse is the head of navigation on the Yukon River system.

The Alaska Highway system contains about 4,000 miles of road included in the federal-aid system. The principal portions of the highway lead from the ports of Seward and Valdez into the interior terminating at their northerly extremities at Eagle and Circle City on the Yukon River, Fairbanks and Nenana on the Tanana



A MAN LIVING IN NORTHERN ALASKA has a multitude of factors to contend with. conditions are equally critical to transportation and construction operations. Light, temperature, and ice play important parts in his daily life. These variable Courtesy of USGS, Professional Paper 301.

RADIO-COMMUNICATIONS EQUIPMENT in road builder's sled-mounted sleeper.

River, and at Livengood mining district about 70 miles north of Fairbanks.

Principal navigable streams of Alaska include the Kuskokwim River, and the Yukon and its larger tributaries—the Tanana, Koyukuk, Innoko and Porcupine. Prior to construction of the Alaska Railroad the mining industry in interior Alaska was supplied principally by boat-barge operations via St. Michael at the mouth of the Yukon extending to the Iditarod, Fairbanks, Circle and Dawson mining camps.

New areas of interest and transport facilities . . . The existing Alaskan rail and highway network falls short of extending into the geologic provinces comprising the new areas of interest. They are, however, traversed or skirted by the navigable Yukon and Kuskokwim river systems with the exception of the Nushagak basin and the Arctic slope provinces. The latter areas fronting on Bristol Bay and the Arctic Ocean respectively are susceptible to supply by ocean shipping on a seasonal basis.

The possible petroleum provinces comprising our area of interest are mostly poorly drained areas with spotty silt covering and contain spotty to continuous permanently frozen soil masses. Intervening areas are for the most part metallic mineral provinces which up to this time have yielded principally placer gold. The intervening areas are all in geologically mobile belts or ancient schist areas characterized by moderate to rugged topography, metamorphism, and thin to absent Recent sediments.

Freighting methods required to accomplish the last leg of transport from rail terminal, waterway, or highway into operational sites—each in its proper place and time—involve use of aircraft, tractor train, or trucks operating on seasonal winter snow roads, or a combination of these facilities.

Importance of Logistics Planning

Diversity of climate and physiographic features, occurrence of permafrost, drainage patterns, timber cover, and soil types introduce a multitude of variables in the planning of operations. Successful application of the art of logistics in a particular locality requires a thorough appreciation of all the variables so that an operator may make optimum use of controlling natural disciplines at the time when they are most favorable to the task at hand.

Tractor train . . . The tractor-drawn sled train reached its highest state of development on the Arctic slope. (Exploration of NPR-4 under U.S. Navy Bureau of Yards and Docks contracts, 1946-1953). Here conditions are ideal with a long winter season, scant snowfall, thick winter ice, and lack of timber. Up to 3 million ton-miles of freighting was accomplished in a single season (December through May) with four trains each using six Model D-8 Caterpillar tractors with three to four sleighs per tractor loaded at 20 to 40 tons each.

Costs in these operations varied with terrain traversed. On a predominantly ice route costs of 25 cents per ton-mile were realized, increasing to $1 per ton-mile in the hilly foothill provinces. In the interior conditions are not so favorable for tractor-train freighting. Topography is usually comparatively rough with timber and many stream crossings and some steep grades are unavoidable. Here tractor-train freighting costs from $1 to $1.50 per ton-mile exclusive of clearing costs, which will average about $300 per mile.

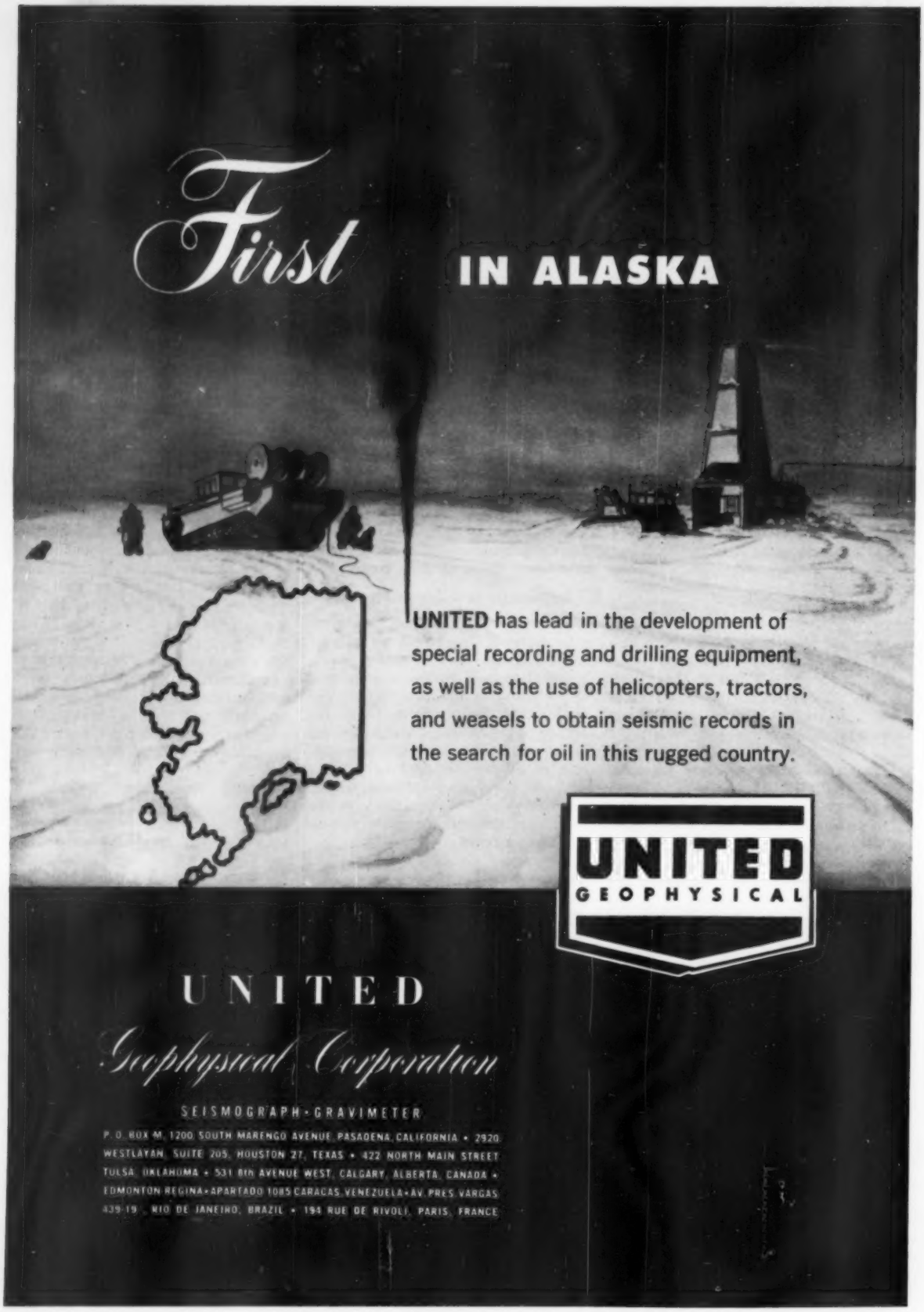
The southwest portion of Alaska has a short variable season when the surface is sufficiently frozen for tractor-freighting. Great care is necessary on ice crossings as ice thickness fluctuates widely with snow cover and swamp or lake type.

Airlift . . . A wide variety of aircraft is available in Alaska for hire or charter. Freighting-plane types commonly used include the Douglas DC-4 and DC-3, the Curtiss C-46, and the Fairchild C-82, or flying boxcar. The DC-4 requires a minimum of 4,000 ft. of runway and will haul a payload of 7 to 8 tons at rate of about 50 cents per ton-mile. The DC-3 will land on a 2,500-ft. runway and will haul for 80 cents per ton-mile. The C-46 requires a minimum of 3,000 ft. of runway and will haul for 50 to 55 cents per ton-mile at loads of 5 to 6 tons. Maximum length of individual freight items will vary with width and thickness. For instance, a 1 by 3-ft. piece 38 ft. long may be carried; a 5 by 4-ft. box is limited to a 10-ft. length. The C-82 requires a 4,000-ft. strip and has a 6-ton payload. The advantage of this aircraft is its 8-ft.-square cargo compartment 38 ft. long with full cargo-size door and a loading height equal to a standard truck bed—hauling costs are 55 to 60 cents per ton-mile.

In the Arctic slope regions the frozen surfaces of lakes, cleared of drifting snow and suitably marked, have provided adequate landing strips for most types of aircraft including the military C-124 Globemaster during winter season. It is estimated that over 60,000 tons of freight was airlifted into the Arctic coastal region of Alaska by commercial carriers during construction of the Distant Early Warning System 1955-1957.

Trucking . . . Truck transport on winter snow roads had been utilized in winter logging operations and short freight hauls in interior Alaska for many years. This method was developed to a high degree by Alaska Freight Lines in 1954-55 and 1955-56 for supply of DEWline construction. Since these developments are new they will be described in some detail.

Construction methods used in building winter snow roads are influenced by the following factors: quantity of freight to be moved, type of haul equipment to be used, terrain to be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covered, physiography of route, and weather. The quantity of freight to be hauled is generally fixed in advance and when changed after construction, an uneconomic haul may result. In general the expense of the road construction may only be justified by rather large tonnage.

The economics of the operation and the logistics dictate that the largest possible hauling units with round-trip fuel capacity be used. Toward this end the Alaska Freight Lines developed for use in 1955-56 a fleet of trucks which gross at 160 tons, hauling an 80-ton payload plus 6,000 gal. of fuel, equipped with 600-hp. diesel engines. Trailers are 60 ft. long and 12 ft. wide. These, of course, are special-purpose trucks and cannot be used on conventional highways. The standard Kenworth 20-ton truck and trailer was also used with good results loaded to 38 tons.

Terrain to be traversed is of course the most important factor as regards cost and construction time. The starting and end point of a haul road are generally fixed, with an infinite number of possible combinations of terrain, physiography, and weather. The ultimate route chosen is a matter of judgment and is an art rather than a science. This choice requires engineering in the broadest sense. The location of the route is made after securing all possible data on the general area. Maps, if available, are closely studied and aerial photos are a great help.

Generally three air flights are made along the prospective route chosen from map studies. The first flight is made at an altitude of 5,000 to 8,000 ft. to determine in a broad way the most favorable physiography. A second flight at 2,000 to 3,000 ft. is made to further narrow the choice and tie together the favorable areas with the best possible path. A third flight at 500 to 1,000 ft. is usually made to check depth of fills at stream crossings, grades, vegetation, soils, and frost conditions.

In these reconnaissance flights a good knowledge of geology is useful as one must be able to recognize rock and soil types, determine the stratigraphy of bedded rocks and probable thickness of detritus mantle. Vegetation types are extensively used to predict the type of underlying material.

The route chosen is followed by tractors with bulldozers pioneering ahead of the construction, and in difficult areas it is necessary for the locating engineer to climb on the bulldozer himself. Complicated grades are laid out on foot just ahead of the bulldozer by means of a Brunton compass, and grade lines are marked with red flagging tied to trees, bushes, or directly on the ground.

Construction methods vary greatly with the location and conditions. Excavation is attempted only during the fall months when depth of thaw is at a maximum. During winter months fills across streams are made by compacting a mixture of snow and moss with trees and brush, if available. Sidehill fills are also built up in this manner to establish grade. Grades are kept to less than 12% with maximum of 8% where possible. Road widths are maintained at 25 ft. with minimum of 100-ft.-radius curves. The large haulage units require a finished road bed capable of supporting loads of 50 psi. The compacted snow fills require at least 1 weeks to set up.

All vegetation is first removed from the frozen ground surface and loose snow compacted into the resulting uneven surface with drags and tractors. Very little maintenance is required except in areas subject to winds. In such areas the accumulating snow must be compacted until the road surface is as high as the general snow level to eliminate drifts. The road must be maintained by drags or motor patrol. Opening up a drifted road by windrowing accumulated snow is not satisfactory because the next storm will fill the road full to the top of the windrows.

From three to six tractors are used for winter road construction and for transporting the sled-mounted living quarters, mess hall, shop facilities, fuel, and supplies which are carried along with the construction convoy.

On average terrain in northern Alaska and Canada approximately 10 miles of finished road construction is accomplished per day. Small streams are filled in the manner mentioned previously. Larger streams with shallow water depth are crossed by constructing approach fills on both sides and crossing on the ice directly, if thickness is sufficient. If not, the ice is thickened by pumping water on the surface and allowing it to freeze in layers or several feet of snow fill is built on the ice.

Experience indicates that 30 in. of ice is sufficient for the largest tractors and 40 to 48 in. for the large trucks on river crossings. Lakes are usually avoided because of the unpredictable ice thickness.

Road-construction operations are carried on continuously during the coldest weather. All equipment is winterized for the low temperatures. A marked increase in equipment breakage occurs at temperatures lower than minus 40° F. because of the brittle nature of some types of steel. Interim supplies and emergency parts are supplied to the construction and freighting crews with aircraft of the Cessna 180, Norseman, or Beaver plane types, operating from frozen lakes, rivers, or prepared strips.

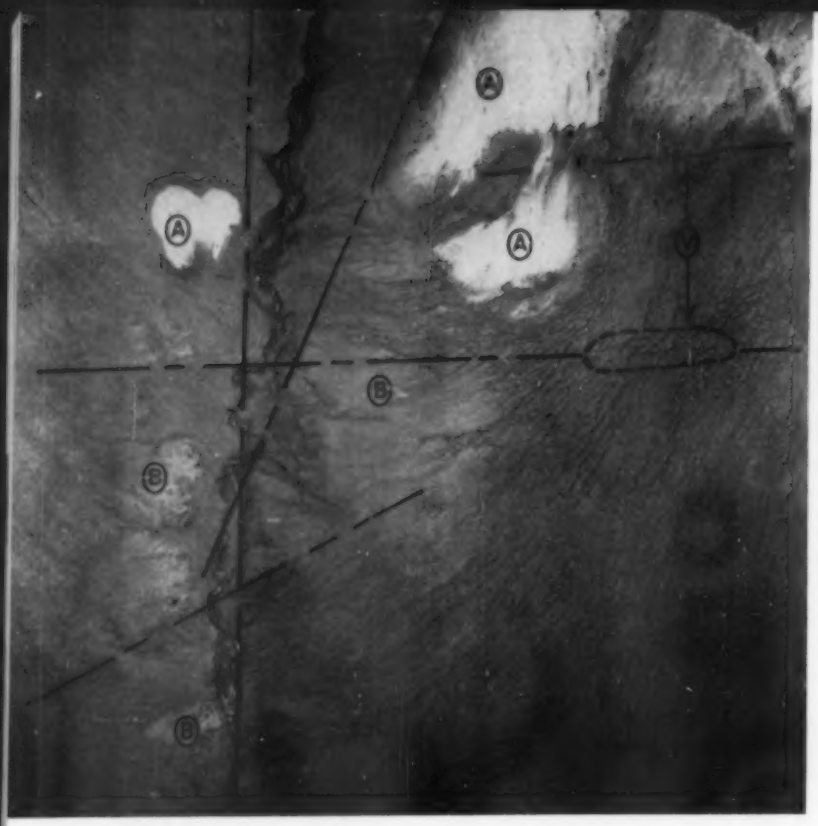
The trucks travel in convoy and haul a tractor, mess hall, and sleeping quarters. Speed varies from 5 to 15 m.p.h. Generally special packaging of freight destined to exploration sites is required and must be designed with the number of transshipments and hauling methods given due consideration. Also important to consider is the weather along the route and the protection required. Many examples can be cited of finely machined parts being ruined from rust because they were shipped to an Alaskan location domestic packed in excelsior and then sat on an open dock awaiting shipment.

Trucking rates over winter snow roads in interior and northern Alaska have under favorable conditions ranged from 30 cents to 50 cents per ton-mile.

Reducing Exploration Costs

Upon extension of exploration into relatively remote parts of Alaska typified by our "area of interest," it is probable that significant economic advantage could accrue to individual operators if the long-range needs of the petroleum industry could be made known to the various segments of the Alaska transportation industry at some workable level on a continuing basis. The first cost of tooling up for supply movements by some of the off-road freighting methods described in this article may be discouraging to such degree as to render exploration costs in any single instance extremely high. However, if one complement of transport equipment, or suitable components of it, could be used for several ventures during a shipping season, costs may be significantly lowered.

Additional reductions could be expected if advance planning was at a stage where several seasons of freight movements could be predicted. Such forecast, well in advance or contemplated field activity, would enable the shipping industry to schedule movements in such manner that delivery of supplies from point of origin to point of use with minimum handling en route would result. In effect the direct responsibility for delivery at point of use could be placed wholly on agencies possessing, or capable of pooling resources to acquire all necessary diversified transport equipment plus proper qualifications for executing all phases of the total supply mission to be accomplished.



A LARGE-SCALE aerial view of permanently frozen ground. Solifluction lines are clearly visible as dark lines extending for long distances (always normal to contours). Areas indicated as **A** are bold "outcrops" of limestone covered with frost heaved rock fragments. Areas marked **B** are "outcrops" buried under the solifluction waste that is derived from the **A** areas. Proven faults are indicated and two "vented" faults are identified (V). Fig. 1.

THE ARCTIC . . .

A challenge in exploration

BY DONALD J. BELCHER
Donald J. Belcher & Assoc., Inc.,
Ithaca, N. Y.

IT IS COINCIDENTAL that approximately the same year that Alaska becomes a new state it also becomes a new province for active oil exploration. Although the new statehood status does not influence the physical potentials of the region, it has given the State of Alaska more appeal than the Territory of Alaska ever had.

In the rush to explore the potential basins, many have ignored the difference between Kenai and, for example, Kotzebue, which is permanently frozen. Although a few companies have "looked" at Alaska in the past, very few have invaded arctic and subarctic regions and yet four-fifths of the potential of Alaska lies in this region. Many are now venturing into the arctic realm of perennially frozen ground and, for that reason, it is advantageous to review some of the exploration difficulties that are associated with the arctic climate.

Need for exploration flexibility . . . Both McKee (OGJ, Nov. 17, 1959, p. 298) and Dickey (OGJ, Sept. 15, 1958, p. 284) have recently cited the need for more thinking and revised thinking with respect to exploration plans and techniques, and Alaska will require much of both. Scientific flexibility is a basic requirement for **continuing** success in exploration as the effort moves from place to place.

To many the arctic will impose conditions that can be met only with revised thinking and new techniques. Subsurface geology can be more accurately portrayed when the facts gained by the use of various exploration tools and devices are welded together and then examined and considered for flaws, gaps and conflicting evidence.

Beyond the use of multiple techniques in exploration, there are two necessary steps to be taken: (1) the modification or adaptation of any or all of these techniques to fit the circumstances of the exploration area, and (2) the digestive process—the mental assimilation of these data.

The digestive process is one that cannot be turned over to computers and it cannot be done properly on a part-time, after-hours basis. Thinking takes time. It is the only means by which solutions can be tried and discarded and half-formed or incomplete concepts be brought into focus.

Much of Alaska, under the circumstances of weather, transportation, labor, and market (which all reflect in cost) requires the best of performance in the field of exploration. And the best exploration will demand a thoroughly flexible approach that permits full adjustment to circumstances presented by one of the greatest problems—permafrost, a climatic influence that changes the physical properties of the earth to depths of 1,000 ft. The effects of ordinary frost, as well as permafrost, have far-reaching influences on established oil-exploration techniques.

Permafrost . . . In correct geologic terms, permafrost is **perennially** frozen ground, but to most it is known as "permanently" frozen ground. This frozen condition of the ground results from a long, steady penetration of subfreezing temperatures that result from an average annual temperature that is below 32° F.

Without question, the arctic climate has endured for sufficient time and with sufficient severity to push the frozen ground limit to depths of 900 to 1,200 and even 1,500 ft. Russian, as well as our own, work in Alaska and Canada has demonstrated this range to be typical in consolidated sediments as well as in metamorphosed and igneous rocks. However, this is a **regional** picture that has specific exceptions and it is one that we will examine more closely later to clarify other important facets of arctic exploration.

The temperatures in permafrost are seldom far below the freezing point and generally they range between 25° to 30° F. Protected at the surface by moss, in some areas seasonal thawing of the ground extends only 12

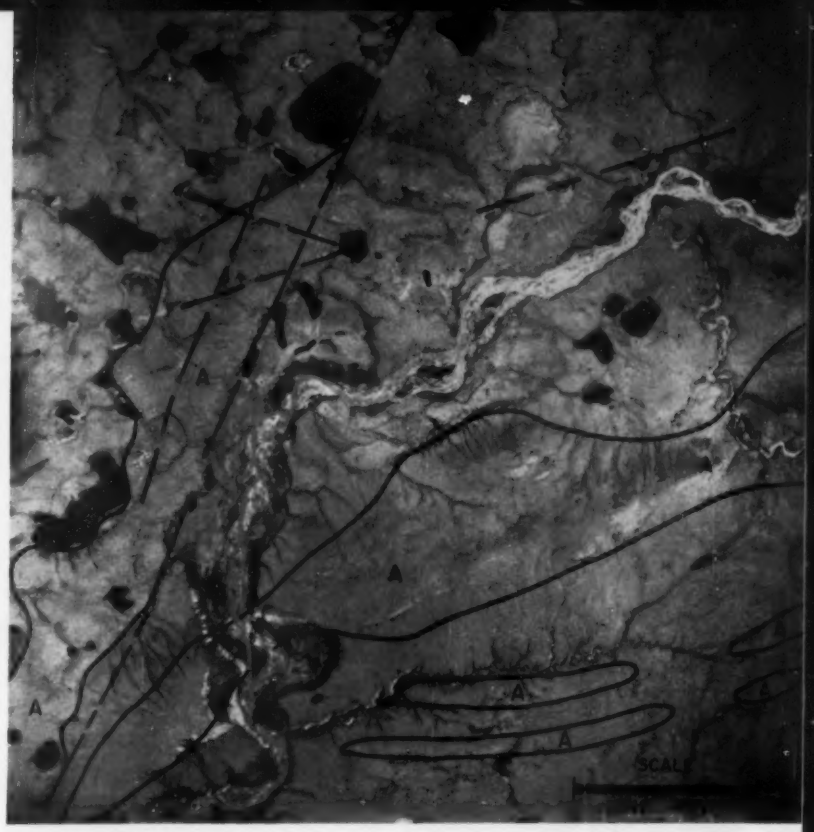
to 18 in. below the cover. On the hilltops, exposed to sunlight and warm air and often lacking moss cover, annual thawing penetrates to somewhat greater depths. This surface temperature, which drives the cold into the ground, is offset by the earth's natural interior heat and a general balance is reached at some depth below the surface. This depth varies with many known factors.

Surface geology is much modified by frost and permafrost in that outcrops are badly shattered and disturbed by frost heaving. Working in the field, it is exceedingly difficult to judge with certainty the validity of dip and strike measurements. What appears from a distance to be an outcrop becomes, on closer inspection, a pile of frost-heaved rubble. Outcrops are points of severe attack by frost and it is not uncommon to find blocks of jointed rock heaved as much as 20 ft. and given a false dip angle, erring usually in the negative direction.

Solifluction, the hallmark of permafrost, is a characteristic of the arctic that creates the monotonous landscapes that are often described as "the arctic wastes" (Fig. 1). Since the ground is frozen below a depth of several feet in the summer, rain and melting snow must escape as runoff. Where there is a heavy moss cover, runoff is confined to a slow seepage in millions of infinitely small channels rather than in gullies. This reduces conventional forms of erosion to nil and, in many areas, virtually eliminates the gullying that normally exposes fresh outcrops. More subtly (and more significantly) the solifluction represents a fantastically uniform mass movement of weathered materials that results from both saturation and repeated freezing and thawing. The fact that each particle is heaved **normal** to the ground surface on freezing and settles **vertically** when thawing accounts for the movement of these materials for considerable distances even on very low slopes.

This mass movement, or solifluction, tends to modify slopes, cover breaks in slope, smother outcrops, and generally blend one landform into another. This results in difficulties in surface mapping of boundaries between rock types or even between unconsolidated and consolidated deposits. Terraces, readily identified elsewhere, blend into the lower flanks of bedrock hills and may be covered by a scattering of rock fragments from the higher slopes, giving a false impression of the presence of eroded shale or thin-bedded members. This condition is prevalent from the Seward Peninsula eastward across the MacKenzie River to the Canadian shield.

An interesting corollary that has developed with experience in these regions is that microfeatures associated with the "decay" of ice polygons enables an experienced photoanalyst to determine the bedrock boundaries by the use of air photographs (Fig. 2).



TYPICAL ARCTIC WASTES. This area is completely covered with frozen unconsolidated marine and continental sediments and some aeolian cover. Folded and faulted Cretaceous sediments (A) underlie some of the area at shallow depths. Experienced photoanalysis will map boundaries and locate faults in this permafrost terrain where there is less than one outcrop per square mile. Fig. 2.

Photogeology

As a device of exploration photogeology is a tool in the kit. Like a tool it has a distinct place in the overall operation. Also like a tool it requires timing in its use and an understanding of the problem as well as the use of the tool. It should be used both early and late in the exploration program as well as at frequent intervals throughout.

Reference here to the use of aerial photography and photoanalysis includes large-scale perspective studies, regional comparisons and correlations, as well as a closeup examination and review of details rather than the so-called photogeology du jour. Too often photogeology is limited to the recognition of outcrops, dip slopes, structures, and faults per se and it derives, therefore, only a small fraction of the total reservoir of information that is contained in the air photos.

First the photographs must be properly analyzed and second the integration with other data should be thorough. A qualified and experienced photoanalyst alone accomplishes more and with greater accuracy than a party in the field working with the results of semiskilled interpretation of photographs. Without specific training in the recognition of rock types and geomorphic forms, fault analysis, etc., serious blunders may mislead the field parties. Such an instance, well

THE AUTHOR

Donald J. Belcher is the principal officer and technical director of Donald J. Belcher & Associates, Inc. Under his direction the firm has engaged in oil and mineral explorations in 12 countries and on 5 continents. Alaska, Australia, Egypt, Iran, and Burma are scenes of the firm's overseas operations in oil exploration.

As director of Cornell University's center for aerial photographic studies he has pioneered in research in photogeology and has instructed many members of the oil industry in this phase of exploration. He holds patents on well-logging instruments based upon fast neutron and gamma-ray scattering.

A TYPICAL AREA in one of Alaska's basins. Folding was preceded and accompanied by major faulting that brought many unrelated strata into juxtaposition. Subsequently avenues or zones of stress greatly distorted structures in many areas. Isostatic adjustment and continued faulting into recent times creates a complex surface picture that is not simplified by the fact that frost has altered most of the outcrops. The white areas are stony surfaces kept free of moss by the constant heaving by frost. The line of dots marks the present position of one series of sandstones and shales that was more perfectly aligned at the time of folding. Fig. 3.

known in Canada, involved the mapping of a white limestone as lava because of the very common cover of black lichens found in the arctic.

Similarly, an area of glaciated alaskite was designated as limestone because of its white color in the photographs although it should have been known that highly acid rocks are those that are bare of lichen cover. It would be well, therefore, for the director of an exploration project to be cautious in expecting results comparable with that obtained in other climates when arctic experience is lacking in his staff.

Fault recognition . . . In most of Alaska faulting is both complex and widespread and of much more concern than is usually credited. In areas where faulting has been considered an intangible minor factor, major faulting has been identified as having several thousand feet of movement in the horizontal component. Thrust faults of even greater magnitude are now known to exist.

In the arctic many faults are extremely difficult to locate on the ground because of the leveling and covering caused by frost action (Fig. 3). Experience has shown that changes in the type of lichens and moss on the surface, probably caused by the different conditions of temperature and drainage in faults, are the only evidence at the site.

Many faults form vents in the permafrost zone and, in varying degrees, they remain unfrozen or are thawed by several influences ranging from circulating water and air from above to convection and/or conductivity from below. There is excellent basis for the belief that many faults that have been smothered by solifluction waste have reasserted their presence by slow thawing from below—a condition that is seldom recognized and yet it forms a partial key to arctic exploration, as discussed under geochemical exploration.

Drilling in several parts of Alaska has produced water in deep faults in ground that is permanently frozen at distances of 200 ft. on either side of the fault. Bound up in the complexities of this thawing, especially at the lower limits of the permafrost zone, is the answer to some of the unusual results of refraction surveys that will, in some areas, consistently show the offset of these faults to be the reverse of the true conditions.

Other oddities, not seen elsewhere, include the "tilted terraces" found along the Yukon, Koyukuk, and Kuskokwim. This is an erosional process, associated with frozen ground, that produces a pronounced backslope on otherwise level terrace surfaces giving them the appearance of dipping sedimentary rocks and thereby leading the inexperienced to the false inference that the valley occupies an eroded anticline.

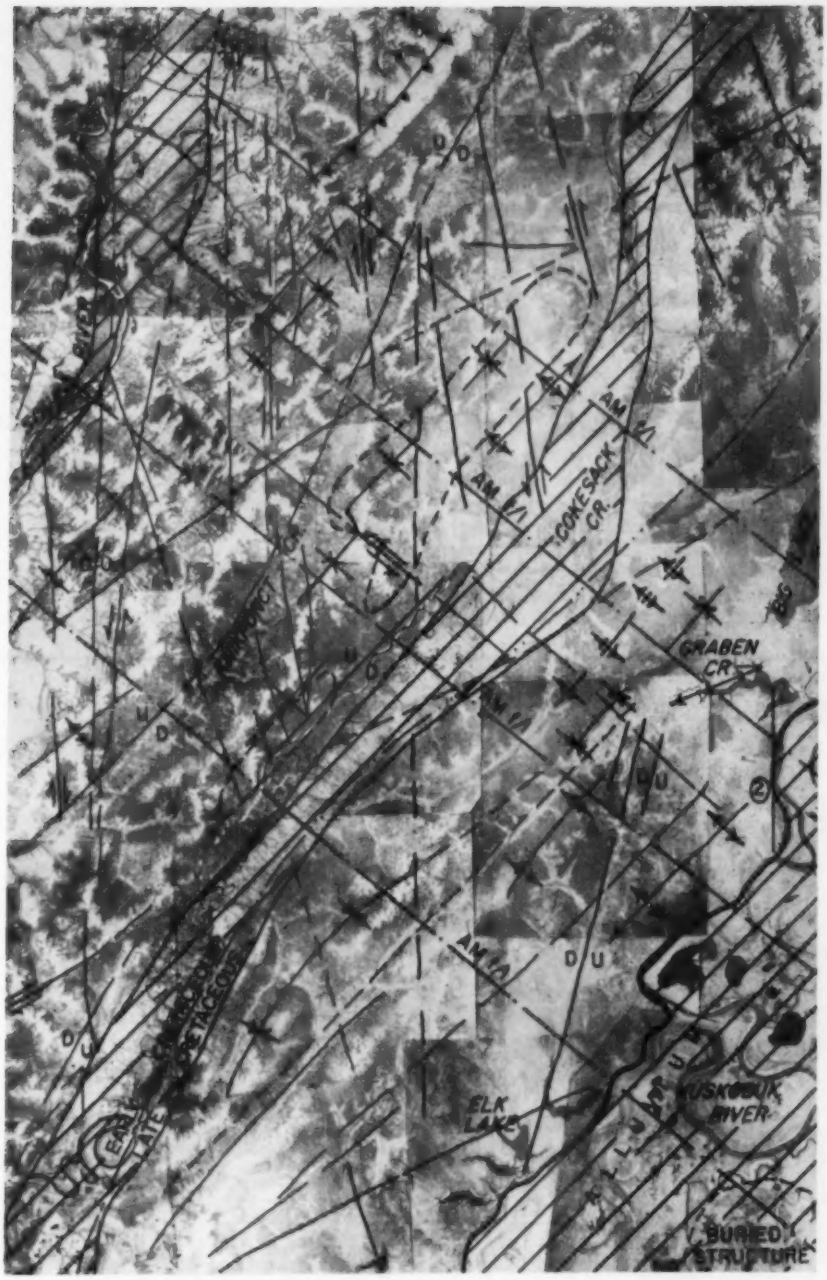
Geophysical surveys, especially refraction surveys, have encountered major difficulties in permafrost areas. Because of the difference in the modulus of elasticity of frozen and unfrozen rock, or for other closely related reasons, the lower boundary of the permafrost, which is independent (largely) of structure, acts as a true surface. This, of course, is not the type of anomaly to be desired.

Correlations have been made in three areas showing the very close conformation of this pseudosurface developed instrumentally and the permafrost base determined by an evaluation of topography modified by surface - slope exposure, orientation, amount of overburden, presence of running water, and ventilated faults, which account for both the general configuration of the permafrost base as well as for variations from the normal.

Geochemical surveys have been relegated to a low state in the general exploration picture but it may well be that they will be modified and revived in Alaska. The failure of many geochemical surveys may be attributed to their use independent of other overriding circumstances and conditions. The grid system of geochemical sampling may frequently become a basic error in exploration tactics. This system is unnecessarily tedious and, more often than not, furnishes misleading results.

While it is true that gases under pressure can migrate through any media, it is also true that they will follow the line of least resistance—such as faults. Therefore, when structures are buried beneath an impervious media (such as permafrost) that is vented by faults, the path of migration will follow the fault zone and be virtually eliminated elsewhere. Research has shown that this same process, combined with many **unrecognized** faults, has probably given rise to the incredibly poor results of geochemical surveys in areas of Texas and the West. In Alaska, as elsewhere, the grid system is informative only under ideal conditions.

The alternative is a "directed" geochemical survey and this, in some respect, offers the only positive evidence of oil and gas in the vast untested



A COMPILATION OVERLAY and photomosaic of a portion of Alaska. Less than 2% of the area contains valid outcrop. Areas of deep overburden without outcrop are shaded. The irregular white areas in the early Cretaceous (upper left) are rocky hilltops with few sound outcrops; the dark areas between, are lower slopes covered with moss. In late Cretaceous area broken rock underlies the moss but very few outcrops exist; the hills are low, rounded, and brush covered. Important faults are shown as well as anticlinal and synclinal axes. Aeromagnetic flight lines are shown but the computed profiles have been removed as have the meaningless geophysical profiles. The asymmetrical position of the two halos with reference to the adjacent structural axes is the key to deciphering the subsurface picture. The encircled number 2 at the faulted end of an anticline marks an oil seep. Fig. 4.

basins of Alaska and nearby Canada. This method provides a high degree of confidence even in negative results whereas negative results by the conventional procedure are meaningless because the grid system may actually bridge zones that are carrying hydrocarbons and sample only areas lacking in significant concentrations.

The directed method of conducting geochemical surveys is based upon the selection of faults that give access to or that "vent" structures at depth. The geochemical process is a sensing device for detecting "microseeps" or leaks that are below the ordinary level of recognition.

A fault or a bedding contact may permit minute quantities of hydrocarbons to escape in a uniform flow. Others may be well sealed but even here the process of faulting and sealing has imprisoned detectable concentrations.

Properly categorized by an analysis of air photographs, shallow faults and deep faults can be segregated. Faults may also be "dated" in order of their occurrence, especially with respect to preerosion and posterosion time. By investigating and classifying the fault pattern, a traverse can be planned that will provide geochemical samples to be taken from fault zones giving direct access to stratigraphic traps and structures or any other reservoirs intersected by the selected fault.

It is important to know that in three of Alaska's basins the ratio of useful faults to the total number in a unit area may be in the order of 1 in 500. This ratio emphasizes the need for experienced direction; with proper planning, a minimum number of samples is required and a minimum of field effort expended—when it is complete the results, either positive or negative, are valid.

The foregoing summary of some of Alaska's exploration problems is brief and incomplete, but it purports to introduce the regional characteristics associated with arctic and subarctic climates. It does not, for example, discuss drilling, engineering, area development, or pipeline phases, which are also much influenced by frozen ground.

If we have learned a lesson in working with others, it has been that exploration data are not compiled in a manner in which they can be assimilated. Although various methods are available, a base map formed of aerial photomosaics is a good technique. Enlarged to a satisfactory scale the photo record of an area can be covered by one or a series of transparent overlays carrying all types of data registered accurately in its relatively ground position (Fig. 4).

No other map can possibly portray the details shown on such a map and, if contact prints are "pricked" in the field to record positions and observations, much loose work can be avoided. With this accomplished creekology, surface geology, geobotany, geophysical (airborne or otherwise), and geochemical results, oil seeps, radiation halos, and any and all other exploration derivatives are matched and overlapped and available for the digestive process. This is the operations research principle applied to exploration.

Oklahoma's Laverne field active

FEATURING a large number of shut-in gas wells, and a correspondingly large amount of gas reserves, the Laverne area of Harper and Beaver counties of Oklahoma promises to be a major gas-producing region. One sand, the Hoover, contains about two-thirds of the gas reserves, but there are three others that contribute to the over-all potential.

This Harper County development has:

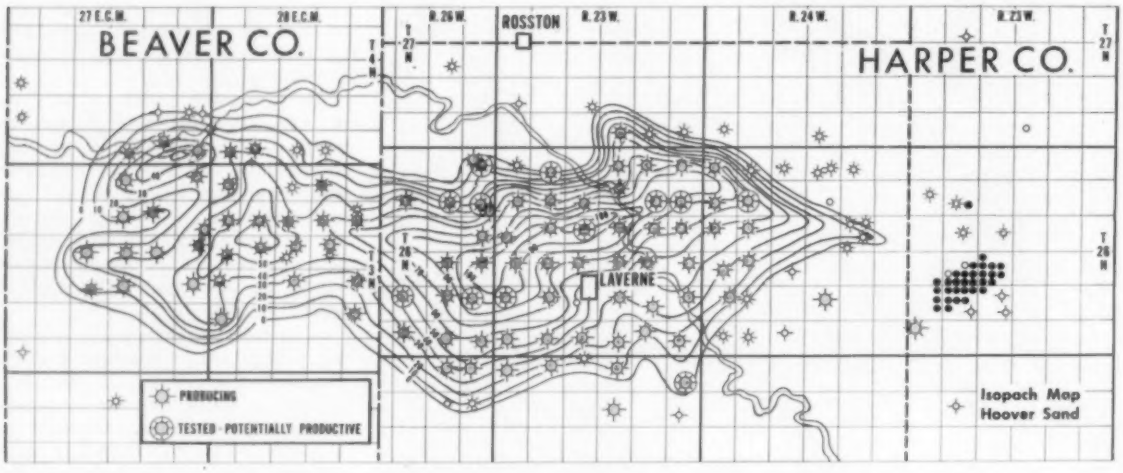
- **New wells**
- **New pipelines, and a**
- **New gas-processing plant**

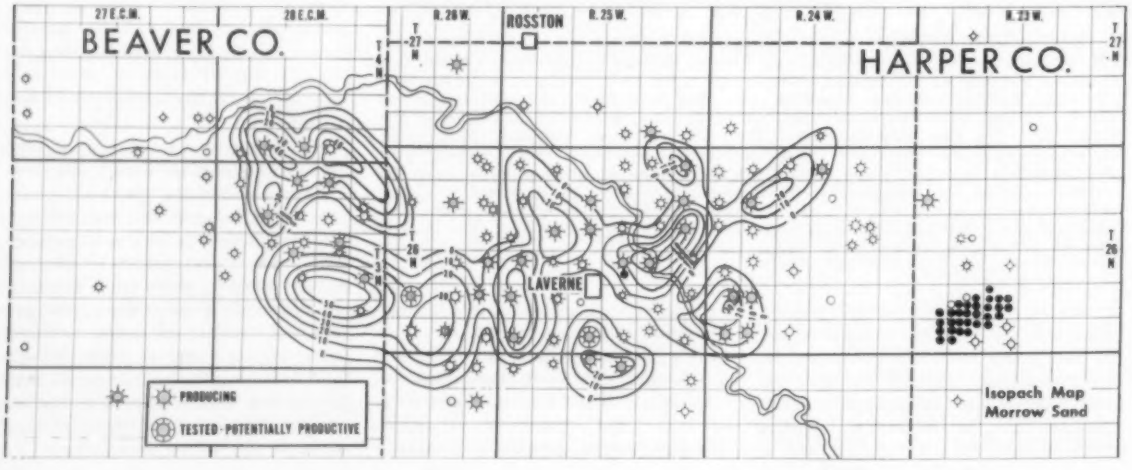
BY W. B. BLEAKLEY
Production Editor

New pipeline . . . Gas wells are shut in because the pipeline companies are not in a position to take gas from the field consistent with the deliverability of the wells. This is due to two things: (1) Michigan Wisconsin started taking gas from Laverne field in mid-December 1958, but the volumes will be limited until the gas-processing plant is completed, (2) the Federal Power Commission only recently approved a Michigan Wisconsin application to expand its system. This approval grants

These isopach maps show

the differences in the character of the four productive zones in Laverne field. The Hoover sand has the most uniform and widespread development. It contains the bulk of the





permission to construct 352.9 miles of 24-in. natural-gas loop and to add 16,560 compressor horsepower to the facilities already present.

Geology

The Laverne area is one of the many producing regions of the Anadarko basin which roughly parallels the southeasterly course of the North Canadian River. Producing formations here dip sharply from the northeast flank of the basin. Deposits are of marine origin, probably as shore lines or sand bars. This is evidenced by the fact that some of the sediments are lenticular in nature.

Several formations in the area are productive of gas and distillate. The principal producers near Laverne are the Hoover, Tonkawa, and Morrow sands of Pennsylvanian times and the Chester, of Mississippian age.

Reservoir data . . . Of the four producing zones in the Laverne field, only one, the Hoover, has uniform development over a large area. The others are spotty in nature, varying in thickness and permeability. This is particularly true of the Morrow and Chester formations. Electric logs of adjacent wells (640-acre spacing) frequently show good development of the Morrow and Chester in one well, and poor development in the other. This is illlustrated in the logs included in this report.

Properties of the four reservoirs are shown in Table 1. Data involving productive area, number of wells, and gas reserves are subject to almost daily change because of the continuing development. This tabulation is accurate to the date of preparation.

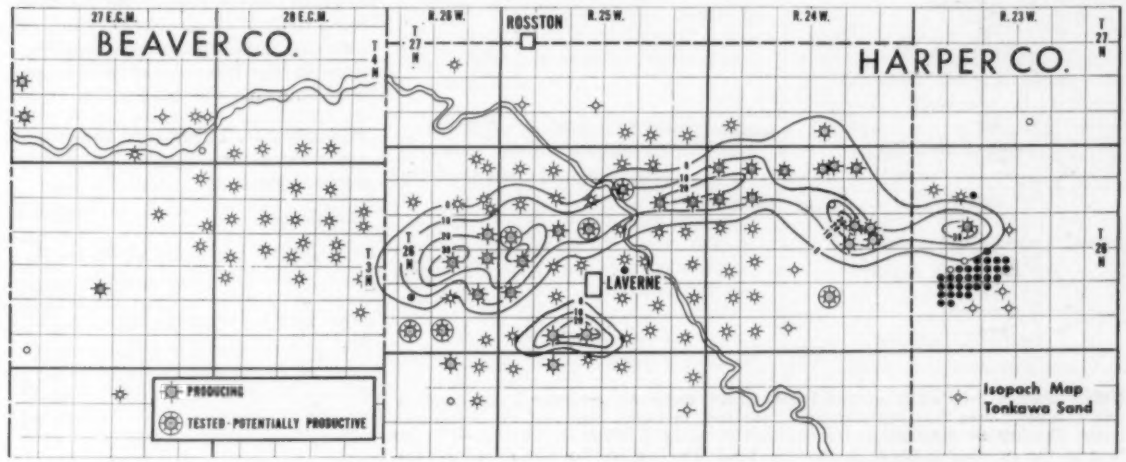
Well Completions

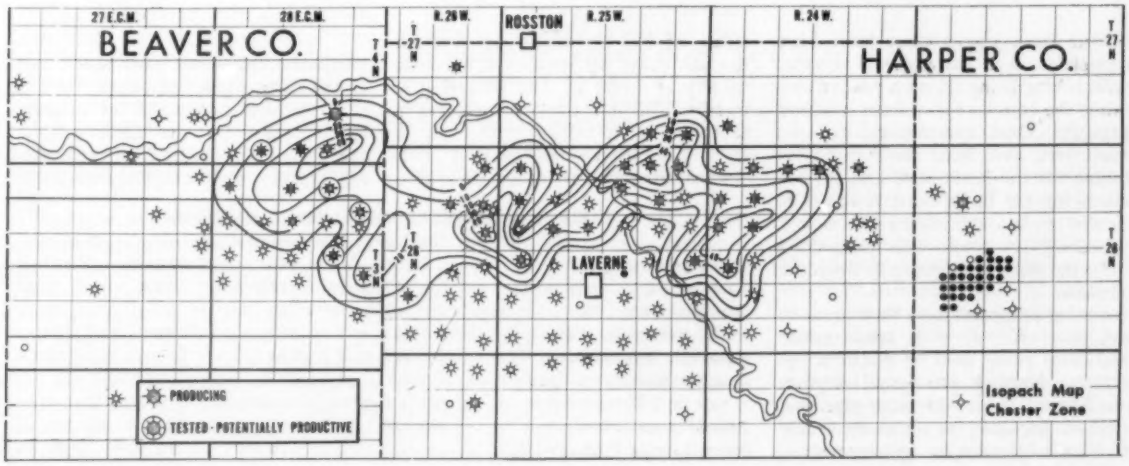
Latest available data show the number of completions in the immediate Laverne area to be as follows: Hoover, 87; Tonkawa, 27; Morrow, 35; Chester, 37. This is a total of 186 completions, and there are 132 wells in the field. Some wells are completed in two or three zones, and many of the single completions have good gas potentials in a second zone. Some have shown good production possibilities in all four formations.

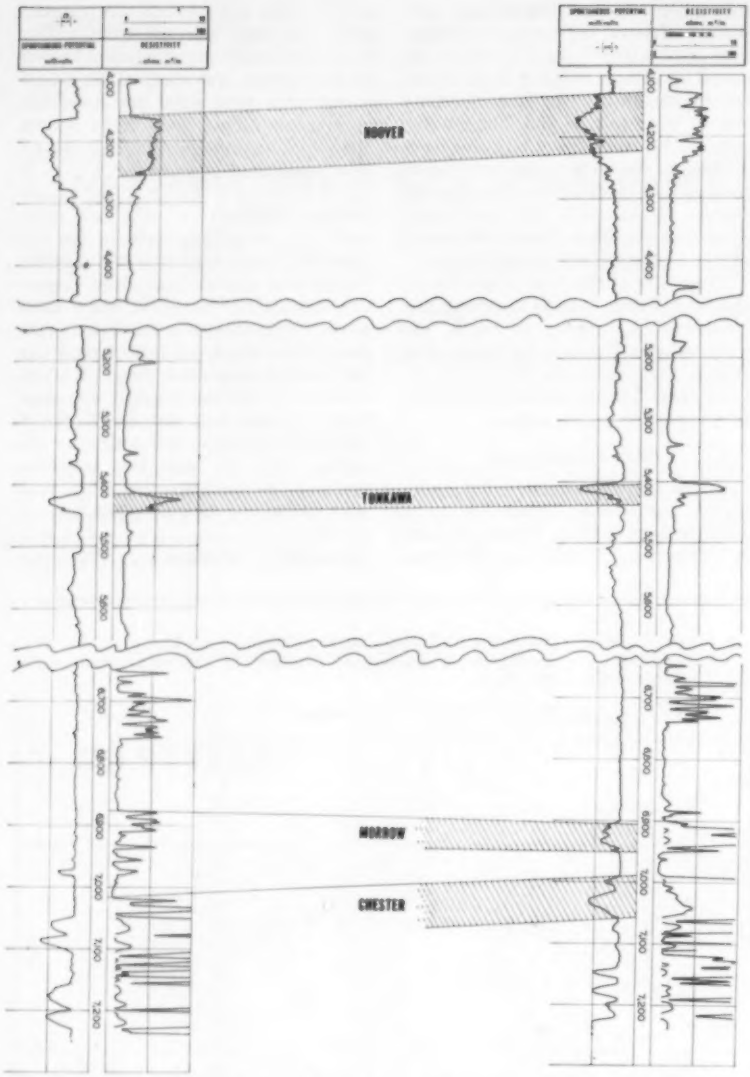
Drilling problems . . . The only difficulty met in drilling wells in the Laverne field occurred near the surface. There is a shallow anhydrite formation that is cavernous in many locations. These caverns present two problems: (1) a whole pit-full of mud can be lost in a very short time, (2) if the caverns are shallow enough, the overlying gypsum will not have enough strength to support the weight of the drilling rig. At least one well has cratered in the area, requiring skidding of the rig to a new location.

Completion technique . . . Wells pro-

gas reserves in the field. The Tonkawa sand has uniform development, but is much smaller than the Hoover in areal extent. The Morrow and Chester formations do not exhibit the same uniformity as the Hoover and Tonkawa, but they contribute a significant amount to the total reserves of the field.







THESE LOGS, of two wells located 1 mile apart, show the variation in the Morrow and Chester zones that has plauged operators in many areas of the Anadarko basin. The log on the right is from a well in which production was found in all four of the producing zones in Laverne field. The log on the left shows a complete lack of development in the two lower zones.

ducing from single zones have been completed in a conventional manner with tubing being set on a packer, isolating the annular space from reservoir pressure. Dual completions, for the most part, have been made using the tubing for the lower-zone and the annulus for the upper-zone production. In the triple completions, two strings of tubing are used, with production from the third zone going through the annulus.

Casing programs have been more or less standardized, with some minor variations being used by different operators. Normal procedure requires one joint of 20-in. conductor pipe, and 13⅜-in. surface pipe set at about 300 ft. This is followed by an intermediate string of 9⅝-in. casing set through the anhydrite, the bottom of which is usually at 3,000 ft. The oil string is usually 7-in. if a triple completion is to be made, or 5½-in. if the well is to be completed singly or as a dual.

Fracturing with water has been used on most Morrow sand completions. The Hoover and Tonkawa formations do not normally need stimulation.

The Chester zone, being an oolitic lime, responds best to acidizing or fracturing with acid.

Well costs . . . The average cost of completing a well through the Chester is about $125,000 depending on the type of completion. Obviously, a triple completion will be more expensive because of pipe expense.

Reserves . . . Several independent studies have been made of the recoverable reserves in the Laverne field. As these represent views of buyers as well as producers, there is some variation in the final results, but not as much as would normally be expected. The following represents an average of the available figures.

Hoover	1,100,000 M.M.c.f.
Tonkawa	170,000
Morrow	300,000
Chester	200,000
Total	1,770,000 M.M.c.f.

These reserve figures are far from being final. Each new well drilled will alter the subsurface picture, particularly in the three lower zones, and new estimates will have to be made.

Wet gas . . . Laboratory analysis of separator gas has shown the average composition to be:

Component	Mole %
CO_2	0.20
N_2	3.04
C_1	86.24
C_2	6.08
C_3	2.79
iC_4	0.35
C_4	0.73
iC_5	0.16
C_5	0.10
C_6	0.20
C_7+	0.11
Total	100.00

While the gas is not particularly rich in the natural-gasoline range, there is a fairly high percentage of propane and butanes for the LPG market. Since the gas is destined for the northern market, it is necessary to dehy-

TABLE 1—PROPERTIES OF LAVERNE RESERVOIRS

	Hoover	Tonkawa	Morrow	Chester
Average depth, ft.	4,250	5,475	7,032	7,077
Porosity, %	17.5	17.3	13.8	6.0
Connate water, %	45	30	30	35
Initial reservoir press, psia.	1,525	1,865	2,180	2,194
Reservoir temperature, °F.	112	130	150	150
Specific gravity of gas (air = 1.0)	0.67	0.73	0.75	0.66
Proved area, acres	86,110	26,000	22,345	23,120
Average pay thickness, ft.	34.55	10.55	18.30	20.29

drate and process it to a high percentage of methane. It was decided that a gas-processing plant could do this economically, and plans were made to build one.

Processing plant construction work has already started at the location 1½ miles west of the town of Laverne. Excavation and earth-moving work was begun about the middle of December.

The plant, a low-temperature oil-absorption type, will separate three products:

1. Propane (95% purity)
2. Butane (95% purity)
3. Natural gasoline (12 lb. R.v.p.)

All electric power will be generated by gas-turbine drive within the plant and the residue gas will be dehydrated before going to Michigan Wisconsin Pipeline Co. Truck and rail-loading facilities are to be included.

Gas will enter the plant at 700 to 900 psi. and at a temperature of about 80° F. The pressure loss through the plant has been specified at 25 psi. Maximum water content of the residue gas will be 5 lb. per M.M.c.f. or less, and the hydrocarbon dew point will be 20° F. at a pressure of 850 psig. or less.

Plant capacity will be 100 M.M.s.c.f.d. of natural gas of the given analysis. Propane recovery will be 75% of that in the plant feed, and essentially 100% of the heavier hydrocarbons will be recovered. The plant is designed for eventual expansion to 150 M.M.s.c.f.d. using the same lean-oil system.

Cost of the plant, not including the dehydration unit, is estimated at about $4,000,000.

Calculated products recovery, at a gas rate of 100 M.M.s.c.f.d., and 55% propane recovery is:

Propane	60,000 gal. per day
Butanes	32,000 gal. per day
Natural gasoline	24,000 gal. per day

Production

The unsettled pipeline situation has prevented any large amount of production from Laverne field. Michigan Wisconsin started taking some gas in mid-December 1958, and the town of Laverne and some of the communities in the surrounding area have been using small volumes for several years.

Because of this situation, no reservoir-performance studies have been made. Reserve estimates so far have been made from pore-volume data, and appear to be reliable, because of the similarity in independent estimates. The application of PVT methods, and the complete evaluation of the reservoirs and well deliverabilities will have to be postponed until substantial amounts of gas have been produced.

WPRA REFINING QUIZ—4

El Dorado question-answer session on ALKYLATION

Part 5 (concluding installment) dealing with cat cracking will appear on March 23. Other installments have appeared as follows:

Part 1 — Cat Reforming — February 23.

Part 2—Maintenance—March 2.

Part 3—Coking—March 9.

W. L. BANKS, Moderator
WPRA Technical Director
Tulsa

GEORGE JANDACEK
D-X Sunray Oil Co.
Tulsa

O. J. WEBB
Stratford Engineering Corp.
Kansas City, Mo.

E. D. MATTIX
Cities Service Refining Corp.
Lake Charles, La.

E. H. McGREW
National Aluminate Corp.
Chicago

W. K. DANIEL
Standard Oil Co. (Ohio)
Cleveland

GEORGE F. KLINE
Blaw-Knox Co.
Pittsburgh

W. L. HOUSTON
Phillips Petroleum Co.
Sweeny, Tex.

WALTER COSINUKE
Catalytic Construction Co.
Philadelphia

GORDON KERNS
Vickers Petroleum Co.
Potwin, Kans.

WILLIAM T. MADDOCK
Ohio Oil Co.
Findlay, Ohio

BANKS: Are refiners who operate HF alkylation units using distillation only as a means of drying charge stock satisfied with performance?

HOUSTON: We've never designed or operated a unit to dry the feed stock only by fractionation. We like to keep the water content of the feed below 20 p.p.m. This is difficult to do with fractionation. We prefer to pay the costs of operating feed dryers as insurance against corrosion and excessive acid losses.

BANKS: Is there any information on types of distribution of fluorides produced in HF alkylation?

JANDACEK: We have some data on our West Tulsa HF plant. A sample of the isostripper bottoms analyzed 65 to 100 p.p.m. Analysis of the debutanizer overhead, the light alkylate and the heavy alkylate indicated that about 70% of the total combined fluorides appeared in the butane stream, about 30% in the light alkylate and essentially none in the heavy alkylate.

BANKS: During a previous panel session a point was mentioned about a possibility of operating H_2SO_4 at temperatures of 50°-55° F. without sacrifice as to acid consumption or alkylate quality and yield. Does anyone have further experience or comparative data concerning this point?

WEBB: As far as the temperature range of 50°-55° F. is concerned, we have very little data where this is the only variable changed. In commercial operations refrigeration is usually limiting, and when temperatures are increased it is because throughput is increased. Therefore, you have a change in isobutane-to-olefin ratio, a change in isobutane concentration, space velocity, etc., along with the change in temperature. We could not say with any degree of assurance just exactly what the function of temperature alone would be in this range. The only thing that we know is that the very best operations in terms of acid consumption are with reactor temperatures of about 40°-45° F.

DANIEL: If we went up in temperature from 40° to 55° we would expect probably a four-number loss in F-4 rating of the light alkylate

and the acid consumption to go up about 4%. There seems to be some question as to the effect on light-alkylate yield from that change.

BANKS: What has been the experience of other refiners when charging sulfuric acid alkylation unit with propylene-butylene feed?

WEBB: We have some recent propylene experience that might be of interest. Several plants are operating on propylene-butylene mixtures. One has been operating on a feed stock with about 40% of the olefins as propylene. The reaction temperature is in the range of 45°-48° F. space velocity is low, isobutane concentration in the reaction zone is in the order of 72-73%. The plant produces total alkylates having end points in the order of 360°-380° F. as a typical result. F-1 clear octane number is in the order of 95.4-95.5, perhaps as high as 96 at times. The leaded F-1 octane numbers of the total alkylate from this unit are around 104.5-106.5.

Acid consumption over the entire period of operation of about 6 months is 0.66 lb. per gal. of total alkylate. Another unit that has been operating for some time has a higher propylene content. This plant averages more like 55% propylene on olefin. Space velocity is considered normal.

Concentrations of isobutane are considered high, 70% plus, and the total debutanized alkylate runs about 400° F. typical end point. The F-1 clear octane number on this unit ranges between 92-93, and with 3 cc.'s TEL the F-1 runs 103-104. Acid consumption for this 55% propylene feed stock averages 1.0-1.1 lb. per gal. of total alkylate.

In one run from this particular unit of several weeks' duration the feed stock was in the range of 75-80% propylene. Throughput rates were very low, space velocities low and temperatures low, refrigeration limiting. Runs on this high-percentage propylene were made at 40° F. reactor temperature. A surprisingly high-quality product was produced. The total debutanized alkylate end point averaged 385° F. during this run. F-1 octane numbers were 103.8-104.5 and the acid consumption averaged 1.2 lb. per gal. Normally, however, other plants with reaction temperatures in the order of 50° and higher have experienced very sharp increases in acid consumption as propylene content is increased above 60%.

MATTIX: We have alkylated up to 80% propylene. We have about 5,000 bbl. a day of propylene feed. We have gone up in temperatures as high as 75° F. As we go up in temperature we find that the reaction is faster. And as we approach 50° F. in our process we are equipment limited. The reaction is slowed down to the point where we start getting into trouble leaving unreacted material in the acid. As to quality, as you go up in temperature our correlations show that for 10° F. rise you drop off about 0.6 performance number on propylene. On butylene that goes down about 1.0 performance number for 10° F. rise.

Our acid-consumption figures are a bit clouded because we alkylate our propylene with fresh acid and the spent acid then is charged to the butylene alkylation unit. So we actually have no consumption on butylene. Acid consumption will run over 1½ lb. per gal. on propylene on this basis. We have alkylated propylene with both pentenes and with butenes being the secondary unsaturates in it.

BANKS: Certain refiners insist on direct firing of the deisobutanizer reboiler to assure defluorination of bottoms. Does experience of those using steam or hot-oil reboiler indicate the necessity of this?

HOUSTON: On our alky unit at Sweeny we operated deisobutanizers with steam reboilers for several years before installing direct-fired reboilers. The primary reason for switching from steam to direct-fired reboilers was that due to revisions in our prefractionation scheme, we diverted a quantity of normal butane around the unit. This was butane in the charge and it had lowered the reboiler temperatures on the deisobutanizers to where we could use steam. With this change in our feed fractionation we were forced to go to fired reboilers primarily to reboil at a higher bottoms temperature in the tower.

We also were pretty glad to go this route to obtain improved defluorination of the bottoms. Using 40-psi. steam reboilers with bottom tower temperatures of 240° F., the fluoride content of the deisobutanizer bottom streams was about 250 p.p.m. After switching to the direct-fired reboilers the fluoride content dropped to an average of about 70 p.p.m., with reboiler heater-coil outlet temperatures of about 400° F. With the steam reboilers the bauxite-treater effluent averaged 40 p.p.m. of fluorides. With the direct-fired reboilers the bauxite-treater averages about 10 p.p.m.

BANKS: How does acid consumption change with changes in the per cent propylene in the total feed?

HOUSTON: This was pretty well covered in the discussion on sulfuric, but we would like to comment on hydrofloric acid. In our units, we note no changes in acid consumption with changes in propylene content of the feed. The acid consumption runs between 0.25 to 0.30 lb. per bbl. total alkylate.

MADDOX: We don't have the experience you have on acid consumption. Unfortunately when we are in the position of having to charge more than 45% propylene in total olefins, our acid consumption tends to become rather astronomical. Do you still have impeller-driven contactors?

HOUSTON: No, we do not.

MADDOX: We are just revising ours. The impellers were removed about 4 years ago and we are now changing up internals. Have you done something like this?

HOUSTON: That's right. On our Sweeny unit that was rebuilt and placed in operation some 7 years ago, the unit was started back into operation without the paddles in the contactors. The olefin feed is injected into the bottom of the contactors. Acid is injected into the side of the contactors in the annulus, the annulus between the center sleeve and the outer shell.

MADDOX: Do you notice much of a change in the performance number as you go up in propyene?

HOUSTON: Not in mixed alkylation where we're alkylating in the presence of butylenes. We note no difference when we change the quantity of propylene in the feed. We would expect a small decrease on straight propylene alkylation. There might be a slight decline in performance number on a 100% propylene feed.

MADDOX: May I ask what your isobutane-olefin ratio is and what are the reactor temperatures?

HOUSTON: Currently, we are running around 6.5-7.5 isobutane to olefin at Sweeny. Reactor outlet temperatures are around 95° F.

COLTHURST (American Petrofina of Texas, Mt. Pleasant, Tex.): I would like to ask Houston what fluoride level in the output is considered safe and does not need subsequent treating for defluoridation.

HOUSTON: I don't have any in-

formation or data on that. On our operating alkylation units that I'm familiar with, we've had no trouble that I know of.

COLTHURST: Have you found it necessary to bauxite treat even though you do have the gas-fired reboiler on your isostripper?

HOUSTON: At the Sweeny unit and at Borger the units in their original design were provided with steam reboilers, so we had bauxite towers. On our Sweeny unit, when we converted from steam-fired reboilers, we left the bauxite treater in place and we are getting the previously mentioned fluoride reductions.

COLTHURST: Does any other refiner have a HF alky unit where they have the gas-fired reboiler and do not have any subsequent treating on the alkylate?

JANDACEK: Our unit at West Tulsa has a direct-fired reboiler on the isostripper. No bauxite treating is used. The numbers that I gave you earlier came from that unit. The light alkylate runs from 30 to 40 p.p.m. of combined fluorides. The alkylate is used for both aviation gasoline and motor alkylate. You know of any problems, Joe, that have arisen because of the combined fluorides in the alkylate?

MILLER (D-X Sunray Oil Co., Tulsa): We've experienced no particular problems, except that we did have a water leak in our overhead condensers off of our rerun tower, and got into a fairly serious corrosion problem until we were able to get the leak stopped. As far as the alkylate is concerned we have had virtually no trouble. I would like to ask Bill Houston if he has had any trouble with traces of ethane in his feed to HF unit and what effect it had on the operation, on fluoride content of butane and alkylate streams, and on acid consumption.

HOUSTON: The only information I have on that is that we consider it undesirable because we get a buildup of noncondensables in the depropanizer and propane-stripper overhead accumulator. We would have to vent this off and that does increase our acid losses, by venting ethane and loosing some acid. We occasionally have that situation when we have some trouble with our deethanizer which deethanizes the propane-propylene feed. We have noted no changes in acid consumption or fluoride levels. It could be possible that the troubles we have had are rather minor and haven't been reflected in fluorides.

MILLER: We have had as much as 0.6% of ethane in our feed to the HF unit and, although we haven't had enough experience on it to determine whether that was the cause of some of our acid consumption and our high fluorides, there is some tendency to believe that.

CHENAULT (Badger Manufacturing Co., Houston): Back to this question of operating HF units without bauxite treaters, and with fired reboilers. We recently finished an HF unit for Champlin in Enid, Okla. That unit has fired reboilers, a conventional deisobutanizer setup, and does not have bauxite treating afterward. There has been some difficulty with corrosion, primarily in valve trim, downstream of the deisobutanizer bottom. To the best of my knowledge that has been eliminated by changing out the trim on the valves.

REIDEL (The Oil and Gas Journal, Tulsa): What about operating with higher isobutane ratio, let's say 10 to 1, or 15 to 1; are there any data on anything like that? Does the yield fall off as you go higher up?

HOUSTON: The data we have on isobutane-to-olefin ratios, up to at least the 10-to-1 region, show there is an improvement in yield factor if the isobutane-to-olefin ratio is increased in the feed. I know of no data that indicate any decline in the yield from increasing the isobutane-to-olefin ratio.

MADDOX: Has anyone investigated the use of molecular sieves for their driers? The next question is—What water content in the effluent do you find on your driers, using bauxite or activated alumina?

HOUSTON: On bauxite driers, the laboratory tests are always down to 15-25 p.p.m. of water after bauxite drying. Some people are reporting some pretty good results from the use of molecular sieves. We put in a short trimmer bed of molecular sieves on the bottom of an alumina bed drying cracked gases. We put them in on a trial basis as an 8-in. layer of molecular sieves on the bottom of the alumina bed. We're doing a good job in those particular driers. We don't know what part of that drying we can attribute to this trimmer bed of molecular sieves.

MADDOX: What do you use for the regenerating medium?

HOUSTON: We use fresh feed when regenerating alkylation-unit driers. We do not try to segregate and use any normal paraffin-drying agents on our alkylation-feed driers. We use the fresh feed to the unit, or the feed that goes through the driers in the regular process cycle.

MADDOX: We have approximately 250 p.p.m. on the outlet of our driers. Do you have any data on space velocity through your driers?

HOUSTON: The 250 p.p.m. sounds awfully high; that's well above the saturation of water in these light hydrocarbons. It might be possible, once you get a slug of water into these driers and mud up the bauxite, that the drier effluent will show high water contents. The 250 p.p.m. at the outlet is a real problem. We wouldn't expect that on saturation levels of water in fresh feeds.

MADDOX: I think it is saturated. We have evidence that it starts out at about the 50-p.p.m. level but drops off after less than 4 hours. We were told by the people who sell the molecular sieves that one of the main reasons for our difficulties is our regenerating medium. We use fresh feed on driers. That is put through the drying bed at about 400° F. and they have strongly advised that we should use either isobutane or normal butane.

HOUSTON: Did the molecular-sieve people advise that you switch, or did the bauxite people?

MADDOX: The molecular-sieve people, even with using activated alumina they insist that we switch if we go to molecular sieves, because of polymerization.

BANKS: Does anyone use natural gas as the regenerating medium for the alkylation-feed driers?

HOUSTON: We have some cracked gas driers that we regenerate with a mixture of hydrogen and methane and have had excellent life and service from these driers.

FLOOR COMMENT: I would like to ask Houston a question concerning his obtaining 20 p.p.m. of water in the drier effluent. Do you use fresh feed to regenerate? Perhaps you have an intermediate processing step such as isobutylene or polymerization ahead of your alky plant? It might, in part, account for this low water content.

HOUSTON: No, we don't have a polymerization step ahead of the al-

kylation unit. We charge to our alkylation unit the total refinery olefin from primarily catalytic cracking. It is a mixture of propylene and butylene. The propylene fraction is deethanized. The propylenes and butylenes are caustic-washed, then dried and charged to our alky unit.

BANKS: There is a difference for testing for water content?

HOUSTON: There certainly is, if you play around with this Karl Fischer reagent test very much. When we got into the cat reforming business and really were interested in water contents, we called in some of our research people to come down and sharpen us up on how to run Karl Fischer reagent tests with good accuracy. There is a chance that these differences in water content could be differences in the limits of accuracy in tests.

It is hard to get representative samples. These new phosphorous pentoxide analyzers offer a lot of promise in measuring water contents down in this region that we're talking about. We have been using some of these on gas driers. To use phosphorous pentoxide analyzers on alky feeds, you have a problem of vaporizing the sample. It is a good procedure if you can get one of these sample strippers, strip the feed with nitrogen, and then take that nitrogen gas into the analyzer. We think that is a more accurate method than the Karl Fischer reagent test.

BANKS: What about the comparisons of F-1 and F-4 octanes of HF and H_2SO_4 alkylate? How do they compare if given the same feed stock, recycle rate, and reaction temperature?

HOUSTON: Our alkylation and design specialists tell us that with recent developments in the design of HF units, the alkylate will be about equal in the F-1 and F-4 octane ratings under the most advantageous conditions of design for both processes.

WEBB: In both the HF and sulfuric-process design a range of product quality can be produced. Recent experience on HF plants and sulfuric plants for which we have furnished the reactors has indicated that high quality can be produced in both processes. The trend currently in HF plant design is to design for much higher isobutane ratios than the current sulfuric plants. If, in the case of water-cooled HF units, the isobutane concentrations are equal, and feed stocks are equal, then the HF units would probably produce somewhat lower quality. However, if the HF units are refrigerated the quality might be comparable. Part of my thinking is based upon the operation of a refrigerated HF unit operating on butylenes, where 105-106 leaded octane numbers have been produced. This plant, however, has isobutane ratios in the order of 15-18 to 1. A sulfuric plant, with those high ratios, and with the same temperatures, would produce in the order of 109.

BANKS: What is the F-1 octane of amylene alkylate and what are the economics of alkylating amylenes?

DANIEL: A comment on the second part of the question: "What are the economics of alkylating amylenes?" Since you are already starting out with something that is in the gasoline boiling range, you need to have a pretty favorable picture to justify the alkylation. Several of these circumstances might do it. First, if you need F-2 octane improvement rather badly—such as if you had a fairly high av-gas demand—and require F-2 for your premium. The second application would be for isobutane upgrading, where you had cheap isobutane available. This could be particularly profitable, particularly if you combined it with an octane reduction on your reforming where you were at a fairly high reforming level. The third application might be from the volatility standpoint. I'm thinking of front-end volatility here. This would be particularly applicable if you were running a rather low-end-point gasoline, so your per cent off on the front end was rather high. Amylene alkylation would be a means of correcting if the problem was serious enough. In summary you probably would need one of those three situations to justify it.

MATTIX: If in making aviation gasoline you are short of isopentane in your blend, then alkylating amylene up to the amount of isopentane you could use in the finished aviation gasoline blend might be economical. It takes a second economical calculation to see where you come out on it. The economics of the two are entirely different.

WEBB: Amylene alkylate quality is about 2.5-3.0 F-1 octanes lower than butylene alkylate produced under the same conditions of temperature and isobutane concentration.

HOUSTON: Our information from HF units indicates that the amylene alkylate will have about 1 number lower F-1 rating with 3 cc.'s. In other words, amylene alkylate will be about one number less than butylene alkylate on F-1 octane rating with 3 cc.'s. With regard to the economics, that would depend pretty much on an extensive study of each particular situation with respect to the conditions that Bill Daniel has pointed out. It is pretty hard to discuss these without looking into every aspect of your motor-fuel requirements: volatility, octane, sensitivities, etc., and that's an individual picture for each refiner.

MATTIX: Our information on amylene light alkylate shows about 138-140 performance number (P.N.) on F-4 + 4.6 cc. The data on propylene average 133 P.N. for the propylene alkylate portion of the unit light alkylate. Our butylene alkylate runs about 146, but ours is mostly isobutylene which I understand is lower than normal butylene.

KERNS: Maybe one of these fellows would like to comment on what amylene does to acid consumption?

MATTIX: On acid consumption our tests indicate the amylene up to 10-15% of the total took a free ride. We have had controversies among personnel in our plant on that, but we have some indication that it is an aid to propylene alkylation.

BANKS: What is industry experience on alkylating high-propylene-content feed?

HOUSTON: We had an occasion when we shut down our cat cracker where we had a propylene-propane feed stock available, and we made a short test run charging only propylene olefin. This test period lasted about 18 hours and we were able to get a limited amount of data which might be interesting. The fresh feed to the unit was 5,134 bbl. a day, contained propylene of 1,194 bbl. per day. The isobutane-to-olefin ratio was 8.26. The consumption of isobutane was calculated to be 1.46 bbl. of isobutane per 1 bbl. of olefin. The total alkylate production amounted to 1.735 bbl. of total alkylate per 1 bbl. of olefin. Average reactor temperature 79°. The clear research octane number of the light alkylate was 92.3. This light alkylate had an ASTM 90% point of 224°. Incidentally, that research octane clear of 92.3 with straight propylene compares to a research clear of 93.5 obtained on light alkylate from mixed propylene-butylene feed. An article in the November 24, 1958, issue of The Oil and Gas Journal describes this trial operation on propylene.

FERRELL (Atlantic Refining Co., Philadelphia): We have a sulfuric acid plant at Philadelphia, and we take our acid strength generally from 98% to the 91-92% range. Could anyone comment on the use of fuming sulfuric acids to reconstitute this spent acid to 98% strength?

WEBB: There was an article published in Petroleum Processing, August 1951 issue, in which the practices on reconstituting acid of 8 or 10 refiners were reported. None of these process arrangements for reconstituting or reclaiming spent alkylation acid are currently in vogue. Everyone to whom I have talked who has had experience with such reclaiming methods feels that the corrosion problems and the general operating headaches were bad. They go to arrangements for burning the spent acid back to SO_2, converting to SO_3 and making new acid rather than trying to reconcentrate or fortify the spent acid.

MATTIX: Recent tests on a butylene alkylation unit in regard to corrosion showed that the corrosion break goes up very sharply with temperature. Low temperatures from that viewpoint are very desirable on butylene alkylation. We have tested from 70°-75° F. on down, and corrosion is bad, especially bad at 75° F. This is in the emulsion section, and not the fractionation section.

WEBB: Would that be within the reactor itself?

MATTIX: Within the reactor and the emulsion section itself.

VERMILION (The Standard Oil Co. of Ohio, Cleveland): Recent data from our new cascade reactors indicates that when producing high-quality alkylate our isobutane consumption has taken a definite shift upwards. Where we used to run in a range of 1.2 bbl. of iso per 1 bbl. of olefin, data now indicates closer to 1.3. Is there any other experience in the industry with these newer units that might bear that out?

WEBB: We have found it very difficult in analyzing commercial operations to calculate the actual yield based on olefins. The amount of olefin actually charged to the unit has to be measured carefully. A series of calculations based on reported olefin contents and the actual alkylate made, and the isobutane in the feed will give figures which vary from considerably over theoretical conversions to figures appreciably under theoretical conversions.

If we average enough readings the number will come out to something reasonable, just under theoretical mol-for-mol quantity. For inefficient process conditions we find that this actual conversion will average out lower. We have not had any average data that indicated more than mol-to-mol conversion of isobutane to alkylate. Incidentally, for butylene that would be under the 1.3 that Will Vermilion mentioned.

MATTIX: I would expect that in changing over to the newer-type reactor you got generally a lower-boiling-range alkylate, less heavy alkylate, a higher-quality alkylate, and therefore I would expect a bit higher usage of isobutane in the process.

VERMILION: We very definitely cut down the heavy alkylate production in this shift. It went from in the range of 12-15% down to about 2 or 4%. Still the isobutane consumption is considerably over the theoretical ratios. Commenting on Webb's remarks about the analyses, etc., of the feed, data used to determine our earlier isobutane olefin ratios were months and months of data that had averaged 1.2 with considerable point variation. We're taking the same type of information now and the calculated consumption for any particular period will vary anywhere from 1.1 to 1.5. The mean is still considerably higher than it was previously.

MATTIX: Is anyone using a material other than lime to regenerate this spent KOH that is used in the scrubbing system on the HF units?

HOUSTON: I don't have any information on that. My experience is limited to caustic soda.

Rose (Tidewater Oil Co., Delaware City, Del.): With our coker on stream at high rates we run into some very stable emulsions in our sulfuric acid alkylation. We tried breaking these emulsions with several additives with no great success. I was wondering whether anybody has had similar experience and has tried any of these proprietary compounds?

WEBB: For emulsions breaking during the PAW operation during World War II, there are references to what originally was Du Pont demulsifier additive. Plots are included in those reports showing the rates of emulsion separation, with and without this additive. In current plant operations this actual additive is being made up in some refineries by mixing equal parts of sodium floride and Kieselgur.

There is a wide difference in opinion as to effectiveness of this additive in decreasing the emulsion problem. Some operators swear by it and some swear at it. We think that for some particular types of emulsions it may be of some benefit. It depends upon the nature of the feed stock and contaminants that may be included in the charge to the plant. As far as the butadiene content of the feed is concerned and its effect on emulsion-separating problems, in the normal range in which butadiene exists in olefin charges, this hasn't been correlated with any separating problems.

PONDER: Would anyone care to comment on the methods of neutralizing HF units for turnarounds?

HOUSTON: We've been using a procedure at Sweeny that we've found to be quite successful—dry neutralization using anhydrous ammonia. The tower is shut down, drained out, and drums of ammonia are hauled in and piped into the bottom of the tower. In something like 6 to 8 hours we get a good neutralizing job with the anhydrous ammonia, to the extent that maintenance people can get into the tower and unhead internal man ways through trays, inspect the tower, etc. I don't have the details of that procedure, but it is simply piping the anhydrous ammonia into the tower and leaving it with some slight positive pressure for a period required to neutralize the tower.

BANKS: In the same connection, what's the best way to dry one out after a turnaround?

HOUSTON: We feel that a good way on your light-ends columns is to dry out by circulating isobutane through the system. In other words, bring your isobutane in dry, and circulate through the system that way and back through the driers. A new wrinkle that we ran into on getting into these towers and doing work on them when we find a buildup of fluoride scale in a tower that has been on stream for possibly 2 years or more, is to use 7.5-10.0% inhibited HCl into the tower at atmospheric temperatures. It does an excellent cleaning job of removing fluoride scale. It works well, and we find that it is a tremendous help in getting these units turned around and back into operation.

EPPARD (D-X Sunray Oil Co., Duncan, Okla.): Houston, on this dry neutralization you were speaking of, do you use that on your acid-regeneration system?

HOUSTON: Yes, we've used it on

our acid regeneration or rerun tower. We've used it on our defluorinator tower and those towers in trace-acid service, clear down through the depropanizer, the propane stripper and the deisobutanizer towers. We find that it works equally well on all towers. We've used it also on storage tanks, acid settlers, etc.

EPPARD: On our unit at the last turnaround we used a hot soda-ash solution, 150°-175° F. and it cleaned the unit very well.

HOUSTON: We used, for quite a length of time, the soda-ash solution and it added greatly to our problem of drying the unit out. It takes more time to actually do this neutralizing with the soda-ash solution and it takes a longer dryout period. We have been able to shorten our turnaround with this dry neutralizing procedure. We still use safety clothing for the people in the towers: that is, rubber suits, etc., inside the towers.

VERMILION: Is there any recent information on the effect of mercaptans in the feed on acid consumption and if there isn't, what criteria are such design companies as Stratco using to justify the installation of caustic-wash facilities on the feed?

WEBB: We think that the sulfur compounds consume at least as much acid as you would calculate on a weight-dilution basis. This means that in charging fresh acid at 98-98.5% and discarding it at 90%, 1 lb. of these compounds would dilute 10 to 11 lb. of acid. This makes the economics very strong for caustic washing or perhaps Girbotol treating of the feed stock. Companies with the most experience are putting on both Girbotol and a two-stage caustic wash.

MATTIX: Our figures on acid consumption in connection with mercaptan indicates much higher than any theoretical calculation. It is somewhere in the neighborhood of 5 to 10 times as high, so we do everything we can to remove the mercaptans.

MONTGOMERY (Socony Mobil Oil Co., East St. Louis, Ill.): We have been getting rid of our HF alkylation-unit acid sludge by burning it under a boiler. Over a period of several years the alkylation unit throughput has been increased, which resulted in more sludge burned in the boiler and severe corrosion of some of the boiler tubes. I wonder if anybody has any comments on a better way of getting rid of this material?

HOUSTON: Are you doing any neutralizing? Is this your acid-soluble oil from the bottom of your rerun or regeneration unit?

MONTGOMERY: We do not neutralize the sludge. It is diluted with a distillate fuel and pumped to the boilerhouse. It is the acid sludge in the bottom of the acid regenerator.

HOUSTON: Water wash with a mild soda-ash solution or something of that nature would reduce the fluoride content. It might be of some benefit. You might want to look at such a scheme.

MONTGOMERY: It would still be burned after doing this?

HOUSTON: I think it a good possibility that it could. Undoubtedly the fluorides are giving you the trouble; those rerun bottoms contain an appreciable per cent of fluorides and HF. Removal of that material by neutralizing the acid rerun bottoms with a dilute soda-ash solution would reduce the fluoride content considerably. You can possibly pump it to a small storage tank and then withdraw the water solution off the bottom.

FLOOR COMMENT: I'd like to ask if anybody is doing anything specifically to remove diolefins. We've heard that there has in the past been some work done on a nickel sulfide catalyst which would selectively polymerize diolefins.

WEBB: We don't have any direct experience with this process, but Shell Development has offered a process for the selective hydrogenation of butadienes. The claims made in this process are that it can be done on large units with attractive economics and that the conditions can be so controlled that you hydrogenate only to the monoolefins and then you can alkylate isobutane with the monoolefins.

OTTENWELLER (Cities Service Refining Corp., Lake Charles, La.): We've analyzed a lot of alkylates in looking at blending values. We've noticed that the higher-quality alkylates have high F-1's but approximately the same F-2's. We find propylene alkylat F-1 + 2.5 cc. to be 102.5 and butylene alkylate F-1 + 2.5 cc. to be 103.5 and F-2 + 2.5 cc. to be 104.0. I wonder if anyone has any comments on that?

WEBB: We do find though that the F-2's are quite high when these very high F-1's are produced.

VERMILION: Our information on the high-quality F-1 and F-2 when we're producing in the range of 110-111 F-2 on total, that our F-2 number is about 108, which doesn't bear out your feeling that the F-2's are remaining low.

WEBB: What numbers are you quoting, Bill? F-1 with 3 cc.'s? F-2's with 3 cc.'s?

VERMILION: Right, both with 3 cc.'s.

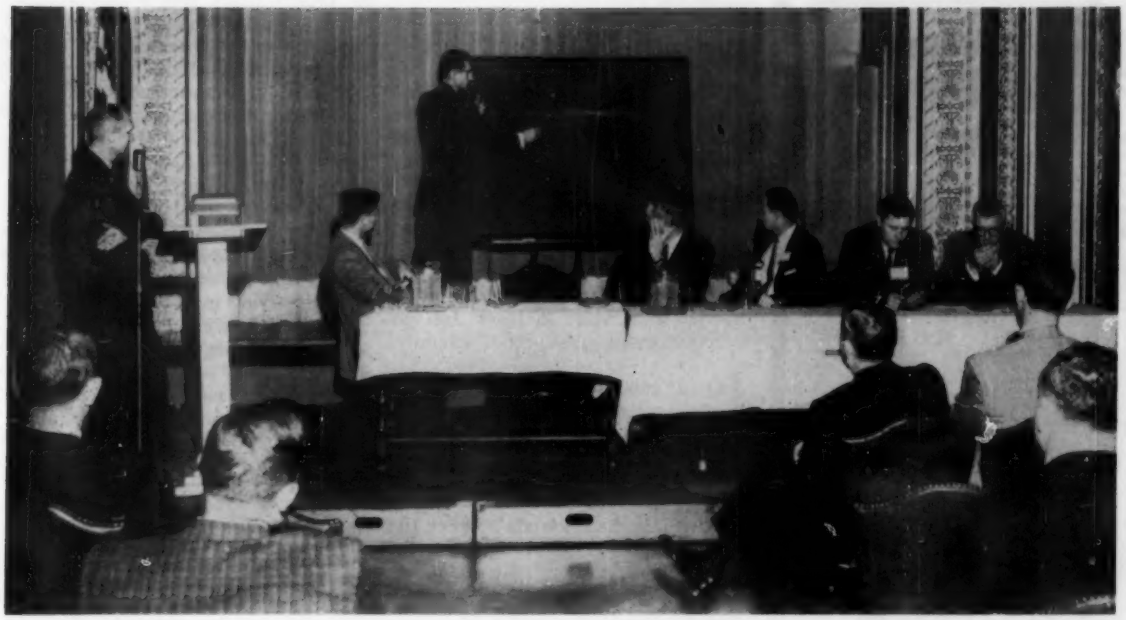
WEBB: Well, we find this F-1, F-2 sensitivity, as I recall it, maintained pretty well as the quality goes up. Your numbers would indicate a 3 sensitivity. Is that right? At higher levels? What would your experience be at low levels like 103 leaded?

VERMILION: Roughly the same sensitivity.

WEBB: On the question of F-1 and F-2 leaded relationships some data I have is on a mixed propylene-butylene alkylate containing about 45% propylene alkylate. The values reported on this sample were: F-1 clear 92.8, F-2 clear 90.5, F-1 with 3 cc. TEL 103.1, and the F-2 with 3 cc. TEL 102.3. On the high-quality butylene samples, Will Vermilion's range of F-1, F-2 leaded octane numbers is what we would expect.

ROSE: We talked to several people about the diolefins problem. Three of four companies have been looking at application of a catalyst to convert or saturate acetylene and butadiene.

NORRIS: We have been working on this particular problem. We had started work for a different reason (from conversion of acetylene). It is quite right that there are several catalyst systems that will work. The biggest problems are contaminants. I don't know that I can give anything more than generalities about this process. It looks like a very low-cost operation under certain circumstances. Shell developed a process in England because they had a high-temperature cracker charging naphthas. In making a mixture of petrochemicals, they made a slug of butadiene. At the time they didn't want it. It was in a stream that contained 15% butadiene in the C_4's and they wanted to convert it all to butylene. The special nickel-tungsten catalyst they developed as best for that, has some tendency for poisoning. There is a paper published on the process in the ACS proceedings of about '47 or '48.



CORROSION PANEL is presided over by Parke E. Muir, Dowell Division of Dow Chemical Co., at left. Members are G. J. Paisley, Socony Mobil Oil Co., Inc.; L. G. Sharpe, Texas Eastern Transmission Corp., at blackboard; J. R. Cowles, Agra Instrument Co.; J. N. Hunter, Jr., Service Pipe Line Co.; O. W. Everett, Oklahoma Natural Gas Co.; and T. L. Canfield, Cathodic Protection Service.

Pipeliners' corrosion quiz

provides practical answers to some knotty problems

The panel discussion which closed the tenth annual Tulsa Corrosion Short Course gave field men a chance to toss their problems into the laps of experts.

There were 225 pipeline foremen, field engineers, inspectors, and superintendents registered for the short course, conducted by the Tulsa section, National Association of Corrosion Engineers. As usual, the question-and-answer period was a highlight of the short course, which in the first 2½ days covered nontechnical presentations on corrosion causes, coatings, galvanic anodes, corrosion measurements and instrumentation, corrosion-control devices, impressed currents, and for the first time, economics.

BY GENE KINNEY
Assistant Pipeline Editor

Q—What is the reason for varying current efficiencies of sacrificial anodes? Why will the same anode have a life of 520 amp.-hr. in one place and 540 amp-hr. in another?

A—Anode current efficiency is a function of the electrolyte (soil), current density, and composition. The higher the current density, the higher the current efficiency. Impurities also affect efficiency. Efficiency will vary with the environment in which the anode is operated, because a local cell action on the surface of the anode itself may vary from environment to environment.

Q—What is the effect of frozen ground on soil resistivity and soil potential surveys?

A—You must be careful to penetrate the crust of frozen surface so as to contact unfrozen soil to get the best interpretation. In the South the crust will be thin and no serious problem. If all soil is frozen throughout the area in which the soil-potential survey is being made, there will be no trouble in correlating data. Where there is considerable frost action, there will be trouble reaching unfrozen soil and hence difficulty in correlation if the survey is made in part over unfrozen soil. Soil resistivity will be affected where the water table is high.

Q—It is feasible to protect hot spots by anodes without insulating hot spots from the adjacent pipeline?

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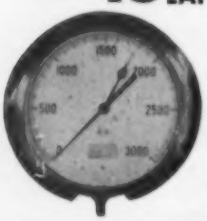

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On the Job

PIPELINING

A—Yes. Concentrate current in the area of hot spots. Spacing of anodes and distance from pipe are factors. In most cases of hot-spot protection of a bare line, it won't pay to insulate. It might pay to insulate if the line were coated.

Q—Can you reduce interference with the use of deep-well ground beds?

A—It is just a matter of getting the ground bed farther away from the line. It is of value in town. Just go deep, if there is no room laterally.

Q—If two coated pipelines with cathodic protection by rectifiers cross, where would you place the half-cell electrode to test for cathodic-protection interference?

A—Place the electrode between the lines to get the same reference for both pipelines. There will seldom be interference if the pipe-to-soil potentials are small.

Q—Can a 2-in. Dresser coupling be coated with hot enamel without damage to the gasket?

A—Yes. Hot enamel cools rapidly. Where considerable dope is used, it could demolish the polyethylene boot. Where the hot tar is held for several minutes, it has been known to loosen bolts.

Q—On a certain rectifier there are two voltage and two ampere readings for each setting. Why?

A—At least one manufacturer lists two ratings for his rectifier. For example, 18 volts and 18 amp. or 24 volts and 15 amp. This means that operating at 18 volts the maximum current is 18 amp. However, as voltage is raised to 24 volts, you are limited to only 15 amp.

Q—In what range of soil resistivities is there no need for cathodic protection to mitigate corrosion?

A—There are some loose classifications as follows: Anything below 1,000 ohms per cm. is very corrosive; 1,000-3,000 ohms is mildly corrosive; 3,000-10,000 ohms presents little corrosion problem; and in soil with resistivity of over 10,000 ohms corrosion is rare.

This rule of thumb is, however, an oversimplification. The controlling factor in the corrosiveness of soil is the relation of soil changes. If a high-resistivity soil of 50,000 ohms drops suddenly to 10,000 ohms, radical corrosion can result, although the rule of thumb states that a 10,000-ohm soil is not corrosive. At the other extreme, in salt flats which have a low resistivity of 50 ohms but which are uniform for considerable distance, corrosion attack is uniform and not too severe.

Q—What spacing should you use in soil-resistivity tests?

A—That depends on the geography, age of the pipeline, and what you are trying to accomplish. In certain areas where hot-spot protection of a transmission line is planned, 50-ft. spacing is permissible. In some areas, the soil may change more rapidly, in which case 25-ft. spacing is needed. In Oklahoma City, for example, 20-ft. spacing is sometimes necessary.

Some recent research may shed light on this question. Studies of a considerable amount of soil resistivity and leak data from several pipelines indicate that soil resistivity over any right-of-way follows a standard distribution curve. From it you can predict high and low points better than by taking readings. Leaks can be predicted, and the rate at which they will occur. This work would apply when designing protection for an old line with a corrosion history. The significance of this work may be in suggesting how often to take readings.

Q—What is the most efficient method of installing magnesium anodes on three bare parallel lines 5 ft. apart?

A—Anodes on the outside line should be placed on the outside of the line. Anodes should be installed as close to the line being protected as practical. Distance from line can be in either a horizontal or vertical direction.

Q—Should the three lines be bonded together?

A—No. All won't have the same current requirements. Sometime in the future if the line is neglected and the anode eaten up, leaving only a connecting wire, there would be a potential anode-cathode setup, between lines.

Q—What is the maximum pipe-to-soil potential without causing damage to the coating?

A—The criterion varies with the

type and condition of coating, also the company. The industry accepts as a safe maximum 2.5 volts. There has been no coating damage reported at the minimum potential required for polarization. Damage has resulted from an applied potential of 10 volts.

Q—Why doesn't the industry use sulfur as a coating material for pipe? It is a good insulator, insoluble in water.

A—Cost is one reason. It has the characteristics of a good coating. It is very durable.

Q—What are the economics of installing anodes on a service connection?

A—When excavating to install service, the cost of an insulating coupling is small. A 1-lb. or 5-lb. anode is cheap. One company uses at least a 5-lb. anode always. If you choose not to insulate, you are not wasting the anode. Some consideration should be given to length of service of the line.

Q—In a pump or compressor station where underground utilities run in all directions, where do you place the half cell for a potential reading?

A—Place the electrode over the line in question. That is a good basic rule. Some pipeline stations are very complicated. You could get widely varying readings within a radius of a few inches. One method is to blanket the area with readings and plot the equipotential readings.

Q—When the ground is frozen and you get no potential reading, what is the reason?

A—If it is very cold, it is easy to pick up frozen deposits on the electrode itself, or the electrode itself may freeze. Frozen soil will affect the reading.

Q—How do you prevent interference with REA neutral systems?

A—Try to isolate the ground rods. Put sufficient bond between the pipe and REA. One power company disconnected the grounds nearest the pipeline's cathodic unit. A pipeline company bonded to the ground system to give it cathodic protection and prevent corrosion of the ground rod or anchor rod.

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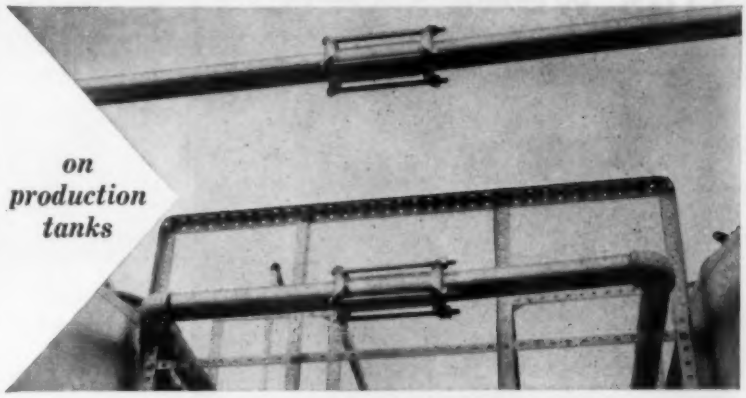

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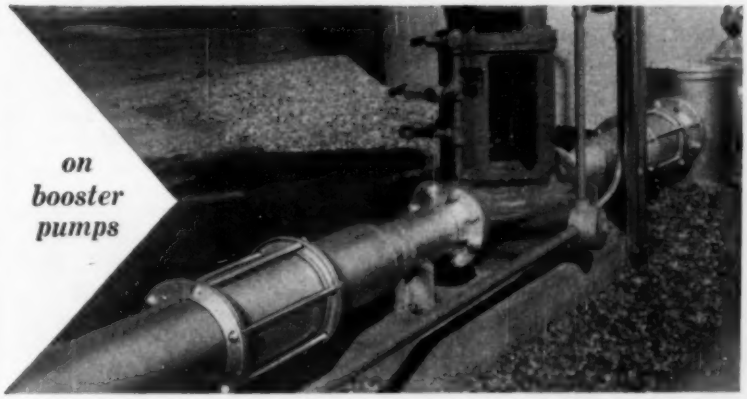

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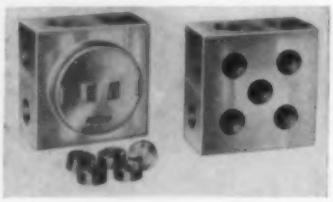

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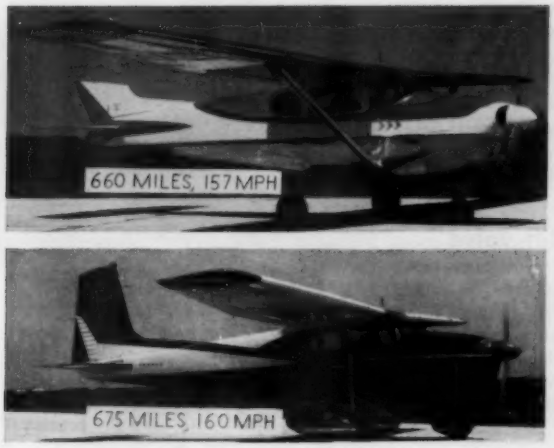

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NEW ISSUE *February 25, 1959.*

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Kettle employs twin agitation

. . . of the filler by a hydraulic-driven sweep and a mechanically powered propeller. The kettle has a heating surface measuring 95 sq. ft.

The Model SPC kettle uses a pressurized fuel tank, eliminating the need for fuel pumps. Kettle capacities available range from 10 to 30 bbl. The kettle may be obtained mounted on tracks or skids. The maker's standard unit is powered by an air-cooled engine. A water-cooled engine is optional. **Write or call: Curtcher-Rolfs-Cummings, Inc., P. O. Box 2073, Houston 1, for details on Model SPC dope kettle.**

Dispersant for drilling mud

. . . eliminates the need for a number of single-purpose dispersants. In all muds, Spersene improves filtration control by aiding the mud to form a more desirable cake, the maker reports. This results in a lower fluid loss than can be expected with con-

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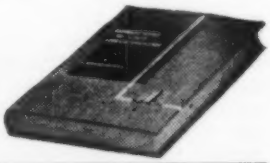
Clarifies the entire field of comparative structural geology



STRUCTURAL GEOLOGY

By L. U. de SITTER

Professor of Geology, Geological Institute of University of Leiden, Holland

552 pages, 6 x 9, 411 illustrations, $11.00

HERE—in one volume—are latest methods, experimental techniques and data, and principles covering every phase of structural geology. They are brought together in a systematic manner that helps geologists analyze and solve with maximum accuracy all types of problems in tectonics. In addition to describing in detail the development and characteristics of every kind of structural formation, the book makes it easier to distinguish the genetic relations between tectonic shapes. By providing a much-needed link between theory and practice of orogenesis, it gives a sound understanding of the world's largest structural units.

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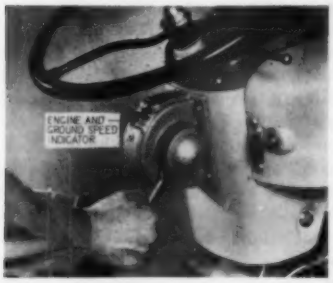
ventional thinners. **Write or call: Magnet Cove Barium Corp., P. O. Box 6504, Houston, for details on Spersene drilling-mud dispersant.**

●



Tractor transmission eases shifting

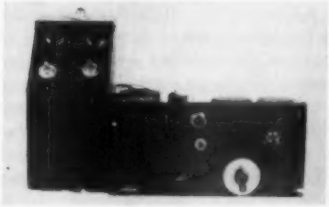
. . . as the operator can change from any gear to any other gear by merely "dialing" the desired gear ration with the small hand-controlled lever just below the steering wheel while the tractor is moving. The Select-o-speed transmission will soon be available on the Ford industrial tractor and is expected to permit improvement in both operator efficiency and fuel consumption.

One advantage of the new transmission is that the operator can select the right gear ratio and speed for loading, dozing, or towing, and he can change them as needed.

The transmission uses a planetary gear-drive principle.

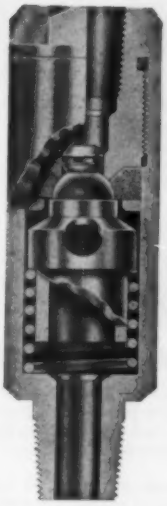
Ten forward speeds are available to the operator. These range up to 18 m.p.h. **Write or call: Tractor and Implement Div., Ford Motor Co., Birmingham, Mich., for details on Select-o-matic transmission.**

●



Highly sensitive seismic amplifier

. . . holds promise as an aid in successful strat-trap locations. The Master Strata Monitor is effective in reducing amplifier decay to such an extent that only the initial pulse of reflected energy is recorded, the maker reports. Close interval events that are often overriden by strong bands of energy are recorded with clear separation. Weak and strong events are characterized by a difference in amplitude.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The Macco normally closed, positive, triple seal check valve represents one of the major developments in the evolution of gas lift equipment. It is a 10,000 p.s.i. test, 5,000 p.s.i. working pressure valve which is manufactured with standard ½" pipe thread connections for installation wherever a fine heavy-duty, dependable check valve is required. Their patented design makes them particularly resistant to the ill effects of abrasive erosion and acid.

Installed on Macco gas lift valves this check valve positively prevents back flow of fluid from the tubing to the casing. They also make it possible to acidize the formation or back-pressure the tubing without exposing the casing to either acid or extreme pressures. A scientifically designed hollow "float" allows all of the gas or fluid which passes through the check valve to pass through the lateral openings and hollow stem. This feature provides protection for the spring. Macco check valves are triple seating—first, a metal shoulder on a "resinoid" disc, metal-to-metal under high pressure, and "O" ring seal.

Write for additional literature or information.

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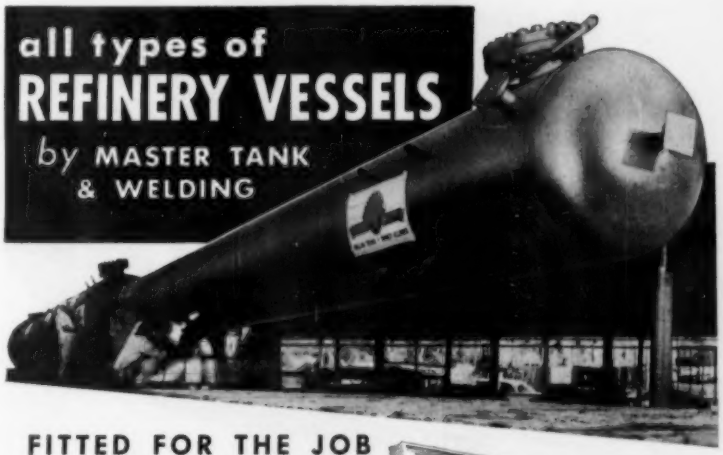

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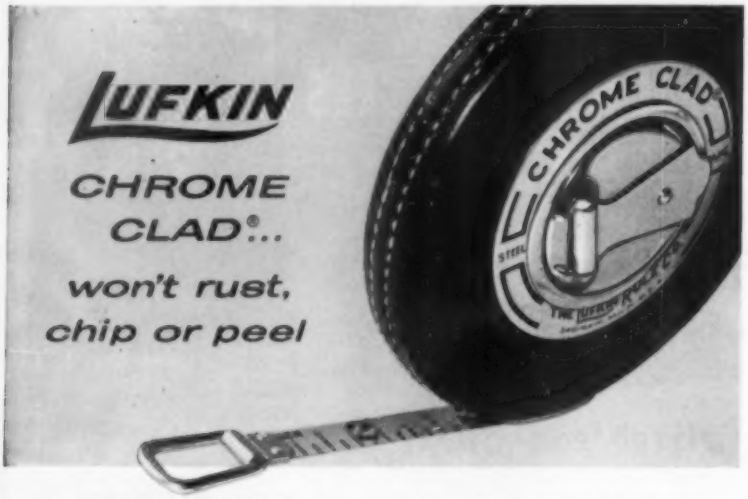

There's no paint on Lufkin Chrome Clad Anchor Tape lines.

The bold, black markings are bonded to the basic metal . . . protected with several electroplatings that give extra strength to the line. The final metal coat is Lufkin's exclusive Chrome Clad finish. Glare free, smooth, rust resistant . . . the most durable tape line you can buy.

Anchor lines are replaceable in the genuine-leather, hand-stitched case. Available with markings in feet, 10ths and 100ths.

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SHOWCASE . . .

New Equipment

The maker reports that a field test taken across a deep well in the Mississippi salt basin showed that reflections were recorded as half-cycle events; amplitude indicated density of reflector; about three times as many reflections occurred as the conventional seismogram and tape playback recorded, and all markers compared favorably to the E-log as to placement and true strata representation.

The amplifier can be used as a one-trace unit with a conventional system for the additional information it offers, as a correlation tool, and as a complete unit for continuous profiling.

The system is a 6-volt one with a power supply of 125 volts. Frequency spread is about 40 cycles down to 6 db. It has 12 stages of filteration, including the open filter. **Write or call: O. G. Singleton, Box 6133, Palestine, Tex., for details on Master Strata Monitor.**

Corrosion-resistant aluminum covering

. . . for insulated elbows is suited for use at installations where fumes and sprays might damage untreated aluminum covering. Exterior and interior surfaces are treated by spraying and baking on colored Copon, an epoxy resin.

Tests conducted subjecting Copon to temperatures ranging from 10° to 400° F. showed no embrittlement or softening of film. After 1,000 hours in both a salt-spray cabinet and weatherometer, the covering showed no film breakdown.

Premetco Aluminels have a 2-in. overlap beyond the turned section to assure a positive closure with straight sections of jacketing. Installation is made with metal-holding screws. Only an ice pick is required to punch screw holes. **Write or call: Preformed Metal Products Co., Inc., 201 Airport Drive, Shreveport, La., for details on Copon Premetco Aluminels.**

SHOWCASE . . .

New Literature

Sulfuric Acid Corrosion

. . . in Oil-Fired Boilers is the title of new eight-page Reprint 76, which describes research made in an effort to develop products for controlling corrosion in the low-temperature areas of a boiler system, such as exists in the economizer and air heater. A company developed several products for controlling low-temperature corrosion and deposits by using the procedure described in the reprint. The company found that the cost for treating fuel in large plants was less than $1 per 1,000 gal. **Write or call: National Aluminate Corp., 6242 West 66th Place, Chicago 38, for Reprint 76.**

Baroid store directory

. . . contains state, foreign, and area maps pinpointing all of the concern's store locations. Names of managers and phone numbers are given. The directory is tab-indexed for quick reference to any location. **Write or call: Baroid Div., National Lead Co., P. O. Box 1675, Houston, for Baroid store directory.**

How to Make Drill Pipe Last Longer

. . . is the title of a newly revised 16-page pocket-sized booklet which covers the causes of and remedies for fatigue weakening of drill pipe. It tells how pipe can be made resistant to fatigue stresses, and what drillers can do to maintain this resistance, thus preventing fatgue failures. The booklet provides information on the protection afforded by properly applied plastic coatings, and on the economic importance of hardfacing for wear resistance of tool joints. Cartoons illustrate conditions that lead to fatigue failure and the methods of lengthening the life of drill pipe. The latter includes proper use of pipe-handling tools, corrosion inhibitors in drilling mud, and the use of drill collars to avoid fatigue stresses. **Write or call: National Supply Co., Two Gateway Center, Pittsburgh 22, for How to Make Drill Pipe Last Longer booklet.**

Teflon-lined expansion joints

. . . are detailed in new Bulletin AD-137 now available. The bulletin describes characteristics and limitations of the following styles of expansion joints: (1) spool-type; (2) rectangular-type; (3) U-types; (4) all-Teflon; (5) full-face Teflon-lined rubber; and (6)

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Even the finest engines, attended or not, can go "wild" and suffer serious damage caused by overheated cooling water or lubrication oil pressure failure. Penn Safety Controls eliminate these two dangers *automatically* by warning you *before* serious damage can be done. Learn more about how Penn Controls can save you time and money, write...

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This Ampco Metal fluid end makes any duplex or triplex pump a better buy. Ampco Metal is an unusual aluminum-bronze alloy that guards against failure due to corrosion, erosion, abrasion, and cavitation-pitting. It provides exceptional strength — yet it weighs 10-15% less than ordinary bronzes.

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expansion joints for use on special piping and flanges. The bulletin presents standard pressure and temperature limitations, plus construction, sizes, and uses. **Write or call: Garlock Packing Co., 433 Main Street, Palmyra, N. Y., for Bulletin AD-137.**

1959 motor-application guide

. . . describes nine major factors in an effort to make motor selection easy. The expanded 16-page publication shows polyphase, single phase, and direct-current motor-selection charts which describe typical motor-driven equipment, show equipment starting and running torques, load characteristics, type of motor to use on equipment, motor type and description, starting currents, speeds, capacity, available enclosures, performance data, and mounting specifications. Bulletin 270-A includes selective-speed drives, mechanical vibrations, and special applications. **Write or call: Century Electric Co., 18th and Pine Streets, St. Louis 3, for Bulletin 270-A.**

Metering-type additive blender

. . . which automatically proportions liquid dyes, solvent oils, and other petroleum additives to gasolines or fuel-oil streams is outlined in new two-page Bulletin 9480.20A. It contains photos of the control system, line drawings of a typical hookup, descriptive text, design features, specifications, and a chart depicting maximum recommended flows for viscous fluids. The blender is a postive-displacement reciprocating-piston type. According to the bulletin, the unit can be used singularly or as multiple units controlled by a single dispatcher to put additives into exchange or pool gasoline. **Write or call: B-I-F Industries, Inc., 345 Harris Avenue, Providence 1, R. I., for Bulletin 9480.20A.**

Pipeline trench backfiller

. . . with its new water-cooled throw-out clutch is discussed in a new six page folder now available. The clutch is cooled by continuous circulation of water from the engine's cooling system, according to the folder. Photos show the machine backfilling heavy soil on big pipelines and illustrates one model backfilling more than 40,000 ft. of trench for 20-in. pipe in a 13½-hour stretch. **Write or call: Cleveland Trencher Co., 20100 St. Clair Avenue, Cleveland 17, for 190 Backfiller folder.**

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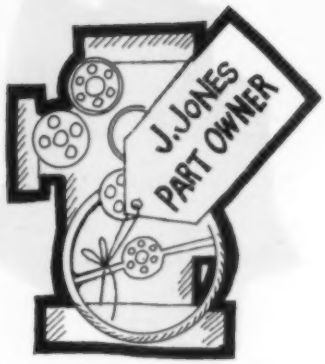
You can borrow money on your present production if you have paid for your interest in at least two wells.



You can borrow on new wells on this property as new wells are completed.

In most cases, you can borrow up to 50% of the present value of the future net income of your property.

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EQUIPMENT MEN

Harold G. Brown is appointed

. . . manager of the general sales office for National Supply Co. He succeeds H. E. Heywood who retired. Brown started in the general sales office in Pittsburgh in 1952, and had been assistant manager the past 2 years.

Coale, Corddry are elected

. . . directors of National Lead Co., succeeding George L. Ratcliffe and Leonard T. Beale.

George B. Coale is a vice president of National Lead and is general manager of the company's Baroid Division. He joined the concern in 1935 as an engineer in the Titanium Division and in 1948 was named chief engineer of the company. In 1949 Coale was appointed assistant general manager of Baroid, and in 1954 became general manager. He was elected a vice president in 1957.

Graham W. Corddry is manager of the Titanium Division. He joined the company 27 years ago as a Titanium Division sales-staff member. He became eastern sales manager in 1936 and general sales manager four years later. Corddry was named assistant manager of the division in 1947 and manager in 1957.

Baroid transfers O. A. Hicks

O. A. Hicks

. . . to Long Beach, Calif. as assistant manager of the Pacific Coast area. Hicks had been superintendent of Baroid Division's drilling mud district at Oklahoma City.

At the same time it was announced that Hubert Sanchez, former store manager at Long Beach, had been made superintendent of the Southern California district with headquarters at Long Beach.

Baroid is a division of National Lead Co.

Clifton D. McCarra promoted

. . . to district manager of Chase Brass & Copper Co.'s warehouse and office in Dallas, according to Walter E. Evans, general sales manager. McCarra succeeds A. M. Johnson, who was promoted to Chicago district manager.

McCarra started with Chase 13 years ago as a salesman at Houston. Soon after he was promoted to office manager. In April, 1949, he was made office manager at Dallas, and for the past year has been a salesman.

Hajovsky, Booth elected veeps

. . . of Plastic Applicators, Inc., Houston. Hajovsky is in charge of the Houston plant and is assistant general

V. F. Hajovsky, Jr.

R. C. Booth

sales manager. Booth heads up the company's Odessa, Tex., operations, which include two plants.

Victor F. Hajovsky, who has been with the company since 1954, has had 10 years experience working with baked coatings. R. C. (Bob) Booth was a corrosion engineer with Shell Oil Co. for eight years before joining Plastic Applicators two years ago.

Macwhyte Wire Rope Co. gets

. . . a new warehouse building in New Orleans, in which to house a complete factory stock of wire rope manufactured by the Wisconsin firm.

Macro, Ltd. is named sales

. . . representative for Oil Metering & Processing Equipment Corp. products, announces Vernon Smith, president of Oil Metering. Macro, Ltd., of Calgary, Alberta, is headed by Larry Darling.

"Technique of Selling" course

. . . which twice recently has been given at the University of Oklahoma will be offered again Apr. 27 and June 1. The course which is planned for petroleum equipment suppliers and service companies, is sponsored by the Petroleum Equipment Suppliers Assn. Classes, which are limited to 25 participants, deal with 14 specific areas of selling.

For more information, direct inquiries to M. L. Powers, Director, Business and Industrial Services, Extension Division, University of Oklahoma, Norman, Okla.

Koehring Co. purchases

. . . Standrill-Keystone Co., Beaver Falls, Penn., a manufacturer and assembler of water well, oil, gas, mineral, quarry, and construction drills and rigs. Purchase price was in excess of $1 million, according to Julien R. Steelman, president of Koehring.

Included in the agreement is a 136,000 sq. ft. plant at Beaver Falls, two affiliate operations at Arlington, N. J. and Orlando, Fla., a sales office at Monte Carlo, Monaco, all machinery and equipment, inventories, and the company name.

R. C. Schenk elected president

R. C. Schenk

. . . of Maloney-Crawford Tank & Mfg. Co., according to Franklin B. Schmick, chairman of the board. David E. Simpson, who has been acting president for the past six months, will remain a vice president. Schenk comes to Maloney-Crawford from Continental Can Co., where he was general manager of the flexible packaging division. Prior to that Schenk had been control officer of Continental Can and formerly was executive vice president of Bowes Industries, Chicago.

New advertising agency starts

. . . operations. McCarty Co. Advertising, Inc., located in Houston, is associated with the international McCarty Co. organization which maintains offices in 10 U. S. cities and several foreign countries.

Company officers are Howard Persons, chairman of the board; Ed Beauchamp, president; and Hal Jones, vice president. R. M. Stonedale, president of Stonedale-Jones, will join the company as a technical consultant. Dave Amidon, also of Stonedale-Jones, will be account executive and office manager.

Union Tank makes two changes

Travis J. Buchanan was named a sales representative for the Midland, Tex. area and Hal Craig Mays was appointed branch manager with headquarters in Odessa, Tex. The moves were announced by Marshall Stirling, sales manager of Union Tank Division of Butler Mfg. Co.

Buchanan was district manager for Oil Center Tool Co. in Midland for

High in the Rocky Mountains, oil and gas producers are turning more and more to Dowell for acid-base fracturing services. Both limestone and dolomitic formations of this area respond well to Acid Petrofrac.

MAKE YOUR WELLS WORTH MORE

Improve Production Potential With Acid-Base Fracturing By Dowell

Most formations—even many sandstones—contain important amounts of acid-soluble calcareous materials. Often, the results of fracturing such formations are improved when an acid-base frac fluid is used.

The reasons for these improved results vary with formation characteristics and the particular fluid used. In general, however, it is believed that fractures are deepened and enlarged. Furthermore, the porosity and permeability of the formation next to the fractures is increased, so well fluids can flow more readily into the fractures.

In many cases, the result is a reduction in the pressure loss between the formation and the well bore, as indicated by an improved productivity index. Often, after fracturing with one of Dowell's acid base fluids, a well that had been on pump will flow for a considerable time.

Dowell can tailor acid-base fracturing fluids to the requirements of nearly any well and treating procedure. Fluids can range from water-thin to extremely viscous. Sand-falling rate can be controlled over wide limits. Acid concentrations can range from less than one per cent to above 20 per cent. Any of several Dowell Fluid Loss Additives (F.L.A.*) may be used depending on the nature of the fluid and other requirements.

Reaction time of the acid can also be varied within wide limits. Most Dowell acid-frac fluids have a retarded action, but some are actually "intensified" to speed reaction.

On the opposite page you will find some of the problems frequently encountered for which Dowell provides proved solutions.

In addition to a complete set of fracturing services, Dowell offers you full research facilities and equipment second to none in the oil fields. These are good reasons why it makes sense to call Dowell for your next fracturing treatment.

For prompt service, or detailed information call your nearest Dowell representative. There are more than 165 locations to serve you in the U. S. In Canada, contact Dowell of Canada, Ltd.; in Venezuela, United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Here Are Some Profitable Ways To Use Acid-Base Fracturing By Dowell

If you need a low-cost acid-fracture treatment:
DUOFRAC*, a Dowell fracturing service that uses dilute acid (1 to 7½ per cent), is designed to help you. Low fluid costs and the ability to dissolve salt are outstanding features. Salt and limestone dissolving properties may be altered by changing the acid concentration. Fluid loss can be controlled within wide limits with F.L.A. Emulsion and silicate swelling problems can be controlled with Dowell addition agents especially developed for the purpose. For low-cost fracturing of even slightly soluble formations, Duofrac may give a quick payout that would be hard to obtain with other treatments. It has given excellent results in formations like the Clearfork of West Texas.

If you want to fracture dense dolomite:
ACID PETROFRAC* with *intensifying* agents has given good results. It uses an acid-oil emulsion that has excellent sand-carrying qualities. It gives a deep-penetrating retarded acid action, yet the intensifying agents aid complete spending with normally slow-acting dolomite. The combined acidizing-fracturing action helps provide both a large drainage area (from fracturing) and permeability improvement (from acidizing). This frequently gives the operator a better well than he could get with either fracturing or acidizing alone.

If you want to fracture a high-temperature well:
STRATAFRAC* may be indicated. This service uses an acid-kerosene emulsion that maintains its stability and sand-carrying qualities even if well temperatures are above 250° F. This high-temperature sand-carrying capacity accounts for the widespread use of Stratafrac to fracture the deep, high-temperature, low-solubility Wilcox sands along the Gulf Coast.

If you have a highly soluble pay:
FRAC ACID* is helping operators to extra profits. This Dowell-developed service uses a specially thickened acid solution as the sand carrying medium. It is designed to give the full benefits of acidizing plus the sand-propping benefits of fracturing. Treatments may be preceded and/or followed with other Dowell acids. Formations like the Mississippi lime in the Texas Panhandle have shown excellent production increases with Frac Acid.

If you want the best possible help:
Call the nearest Dowell engineer to help you plan the treatment for your well. He can draw from Dowell's vast background of experience to help you choose between Dowell's wide variety of acid-base, water-base and oil-base fracturing fluids. His knowledge of local conditions can be important aids in your planning.

*Dowell Trademark

NEW "FRACTURING GUIDE" Now in use *exclusively* by Dowell engineers, this revolutionary new system has increased the success ratio of fracturing treatments by more than 50%. Ask your Dowell representative to *engineer* your next treatment using the "Guide" manual. This extra service costs you nothing.

the past 10 years. Mays, who started with the division last year, previously worked in drilling and equipment sales for Baash-Ross Tool Co. and Associated Oil Field Rentals in Hobbs, N. M.

Dr. Gray rejoins Baroid

. . . Division of National Lead Co. as assistant manager of the drilling-mud department. He left the firm a year ago. Dr. George R. Gray first started with Baroid in 1943, and for many years headed the sales and service laboratories before transferring to the drilling-mud department as chief engineer. Prior to joining Baroid, he served as senior research engineer with Humble Oil & Refining Co.

Dorr-Oliver Inc. announces

. . . an agreement with Salt Water Control, Inc., by which the latter firm will add the new DorrClone desanding system to its line of process equipment. The system was designed for removing sand and silt from water supplies.

Salt Water Control headquarters in Fort Worth and will market the product throughout Texas, New Mexico, Colorado, Oklahoma, Louisiana, and western Arkansas.

Walworth Co. announces

. . . that Grove Valve & Regulator Co., Oakland, Calif., will act as sales agent for specialized lubricated plug-valve products to certain companies. The Oakland company is a subsidiary of Walworth.

Jack Huddle is added

. . . to the sales engineering staff of Grove Valve & Regulator Co., according to George C. Doty, vice president and general sales manager. Huddle will headquarter at Odessa, Tex.

Dresser establishes a new

. . . department for the sale of oil and gas-transmission pipeline products, announces Charles Kuhn, sales manager. W. F. Krueger was appointed department manager.

Krueger, who joined Dresser Mfg. Division in September, 1956, previously worked for Sperry-Sun Well Surveying Co. in Houston, Tulsa, and Philadelphia. Prior to that, he was with the U. S. Bureau of Mines and Standard Oil Co. of New Jersey.

Martin G. Browne is promoted

. . . from district sales engineer to district manager of Diamond Oil Well Drilling Co., Midland, Tex. During his 11 years with the company, Browne has served as purchasing agent, sales engineer, and district sales engineer.

Howard H. Sanders is named

. . . sales representative in Southern Texas for Leschen Wire Rope Division, H. K. Porter Co., Inc., reports Gordon N. Dow, general sales manager. He will headquarter in Houston.

Sanders was formerly secretary-treasurer and general manager of E. A. Lange & Co., Inc., Burlington, Iowa, a Leschen distributor.

Oil Loans

ROBERT F. CASHEN, Assistant Vice President
Manager, Petroleum Department

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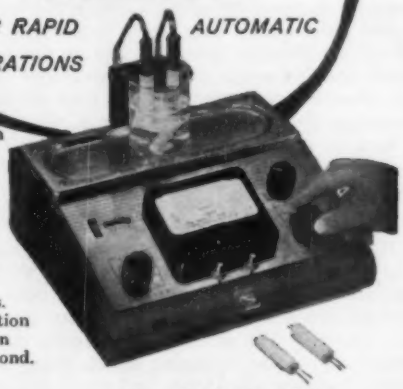
COULOMETRIC TITRATOR
FOR RAPID AUTOMATIC TITRATIONS



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Hardy-Griffin makes five

. . . personnel promotions and additions in its sales and service staff, announces Joe Safford, vice president and general manager.

W. L. Phillips and D. C. (Cliff) Mayes were appointed divisional sales managers. Phillips will be responsible

W. L. Phillips

D. C. Mayes

for the territory east of Houston, and Mayes for the territory west of Houston. Both men have more than 20 years oil-industry experience.

Additional sales and service men named to work out of the Houston office are William B. Phillips and Warren Hill Parsons. Jack P. Walding has joined Hardy-Griffin Engineering Corp.'s Odessa, Tex. office and will handle sales and service.

Jouanet new vice president

. . . of Well Instrument Developing Co. He began his oil-industry career in 1935 with Schlumberger Well Surveying Corp. The new executive vice president joined Well Instrument Developing Co. in Houston four years ago, following eight years of service with A. O. Smith Corp.

BJ Service, Inc. opens new

. . . Gulf Coast division headquarters in Houston, reports John B. Merritt, president and general manager of the Borg-Warner subsidiary.

C. R. (Curt) Cross, Gulf Coast division manager and a 7-year veteran with BJ, will make his headquarters in the new office. He will supervise the eight coast stations and offices.

Cleco Air Tools makes four

. . . new appointments, announces Ed Clayton, sales manager of Cleco, a division of Reed Roller Bit Co. S. L. Brown, Jr., was named general sales office manager. He joined the firm in 1947 as export and repair-order supervisor. He later served as sales office supervisor.

J. G. Hudson is the new assistant sales manager. He worked for Lincoln-Mercury Division of Ford Motor Co. before he joined Cleco in 1953 as a salesman in the Dallas area. Four years later Hudson moved to the Houston area.

J. D. Browning was named senior salesman of the Houston territory. He was with Continental Oil Co. before coming with Cleco in 1950. He worked in the Houston area and was transferred to the Los Angeles division in 1954. Browning returned to the Houston office in 1956.

L. E. Luthy joined the company as a salesman in Houston. Previously he worked for Univac Division of Remington Rand Corp.

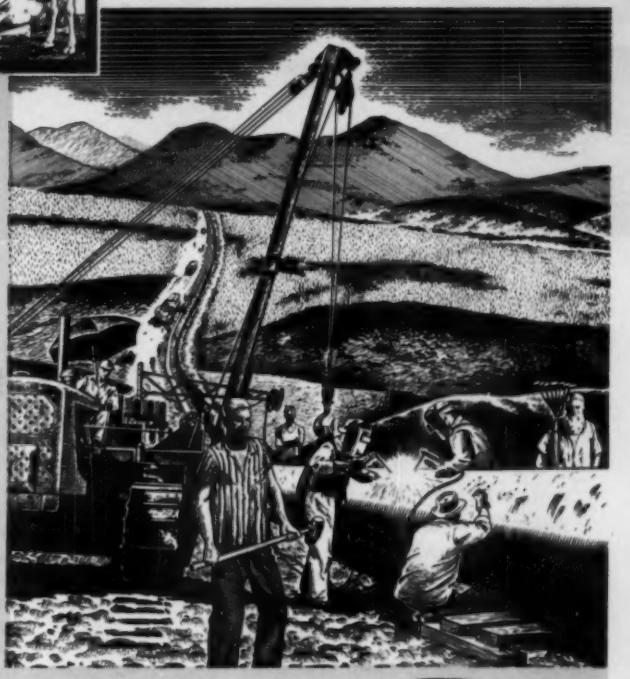
Tom J. Walne is appointed

Tom J. Walne

. . . assistant manager of the International Division of Cameron Iron Works, Inc. The announcement comes from J. H. Grubb, International Division manager.

Walne will assist Grubb in all phases of the company's operations outside the United States and will locate at the company's Houston office.

Pipelines are in the News



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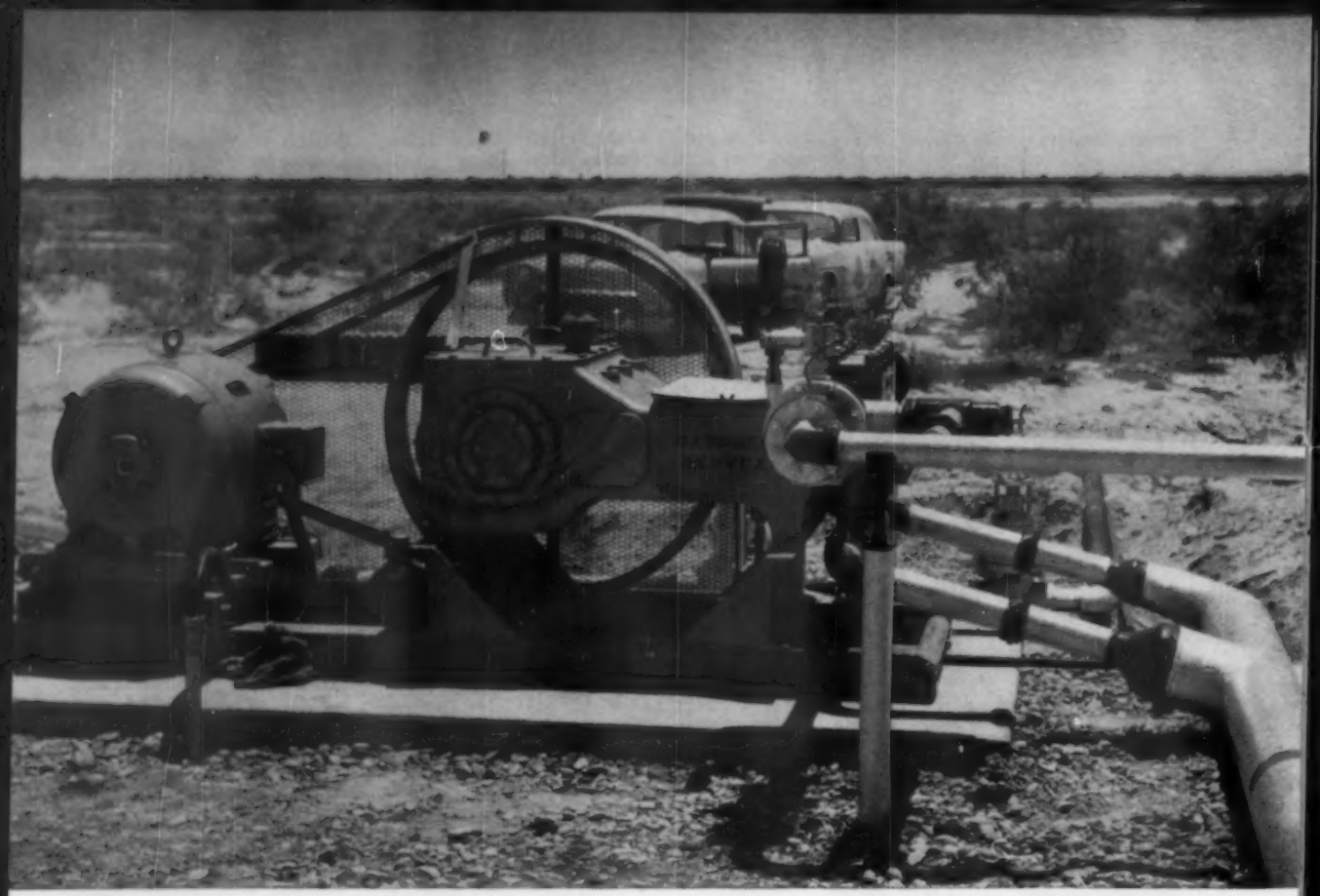

30 hp Century Electric motor driving reciprocating pump in Texas water flooding project.

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Here's thirty tough horsepower of dependable motor. Driving a reciprocating pump in a Texas water flooding project, it has to be on the job 24 hours a day with power ready when needed. But maintenance is no problem. Century Electric motors are built to take the rugged punishment of any oil industry operation—in drilling, production, pipe line and refining.

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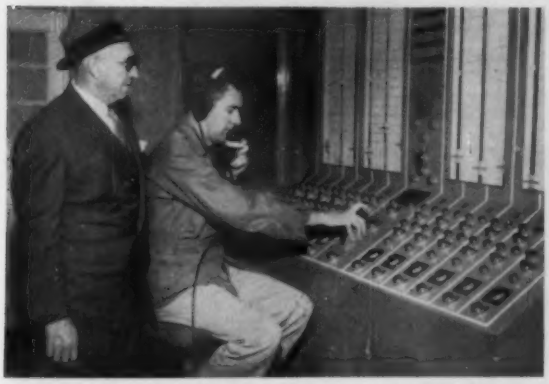

PRESIDENT L. J. ROUSSEL watches Chief Engineer E. J. Brinkmann check central controls on Universal Drilling Co.'s new offshore drilling barge.

"MR. LOUIE" gets inspection at New Orleans wharf. Conspicuous are some of the barge's legs and raising jacks.

Stability, safety are drilling barge features

INNOVATIONS designed to provide greater stability and safety in operation are incorporated in the large offshore drilling-barge assembly recently commissioned by Universal Drilling Co. at New Orleans.

The new mobile unit, named "Mr. Louie" for Louis J. Roussel, president of the company, is one of the largest to go into service in the Gulf of Mexico. It is capable of drilling to more than 20,000 ft. in water depths up to 120 ft. with 40-ft. clearance above waves.

Hull of the drilling platform is 95 ft. wide, but special outrigger-like wings on each side increase the over-all width to 133 ft. This is 32 ft. wider than the giant passenger liner, S.S. United States, and makes the barge one of the largest pieces of floating equipment ever launched in the United States.

The wings lighten the over-all weight of the barge while increasing its stability. The extra stability is provided by the barge's additional four caisson legs built into the wings. Altogether the barge has 12 of these legs, each 6-ft. in diameter and 211 ft. long. Eight of these extend through the barge-platform proper. Outrigger legs were designed by Roussel and Emile J. Brinkmann, Jr., chief engineer of the company.

The drilling platform is self-elevating. Raising or lowering is by a new type of positive acting, double-locking hydraulic jack, one for each of the 12 caissons.

The jacks, invented by Roussel, work as a unit or independently. Their controls are from a central panel located amidship with full view of the entire deck operation and all jacks. Jacks are always locked either in fixed or movable position by automatic safety valves which engage one set of the jack's gripping jaws before releasing the other.

Another innovation is a Roussel-invented locking mechanism for skidding the derrick into drilling position. The derrick is a three-well Lee C. Moore 140-ft. installation with a 46-ft. by 30-ft. base. Its substructure is skid-mounted on special tracks and powered by hydraulic jacks which can move the derrick into three locations. This makes possible the drilling of nine wells without moving the entire barge. Drilling is through a 46 by 34-ft. keyway in the barge hull.

Four boarding ladders, one at each corner on the barge's hull add both a further safety feature and a means of gaging the barge's draft. The ladders are for emergency exit and reboarding, but rungs are spaced one per foot so that the water depth can be observed readily.

Thirty-five watertight compartments in the hull make the barge assembly virtually unsinkable. The barge is capable of withstanding a collision, flooding as many as four of the outboard compartments, having all of the live load (pipe and casing) shift to one side, and still maintain a metric height of 10 ft. This exceeds need to maintain stability. Mud storage and mixture tanks are strategically located amidship so that increase or decrease in load will not affect stability of the barge.

Main drilling equipment includes a Unit 1220 draw works assembly, powered by two 900-hp. electric motors, and two 818 Emsco D-1000 mud pumps, each having a 550-hp. electric motor. Electric power is supplied from a bank of three 1,000-hp. Alco diesel engines driving three 800-kw., d.c. generators and two 425-hp. a.c. generators (the latter for ship's service).

An 80 by 80-ft. cantilevered heliport off the stern gives the drilling barge an over-all length of 249 ft. It has a draft of 22 ft. Built by Port Houston Iron Works at Houston, the barge was towed to New Orleans for completion and commissioning. It has been slightly more than a year in construction and outfitting.

Roussel, who organized Universal Drilling Co. in 1956 and is its president, has been a successful independent oil operator for 20 years with producing properties not only in South and North Louisiana but also in Oklahoma. He was the organizer of Gulf Natural Gas Corp. which operates a gasoline-processing plant in Pine Island field, Caddo Parish, northwestern Louisiana. Associated with him in the offshore drilling company are Earl S. Binnings, vice president; John F. Hartman, treasurer; and Francis E. LeJeune, secretary.

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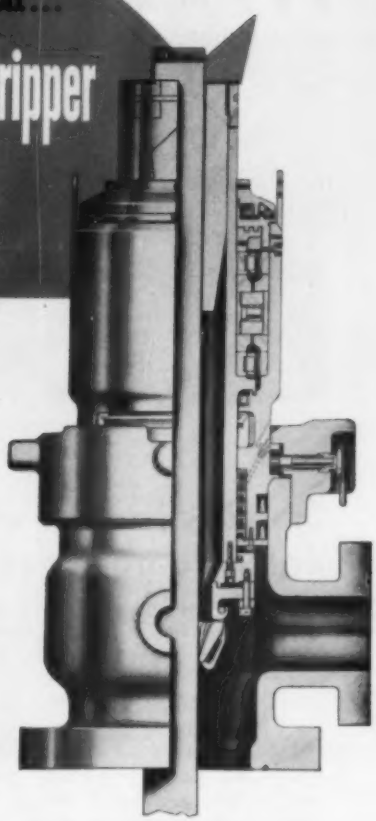
The Shaffer Rotating Blowout Preventer and Stripper IS UNEQUALLED!

WHENEVER you're drilling in unknown formations—or in troublesome zones where pressures are a problem—make sure you install the unequalled protection you get with the Shaffer Rotating Blowout Preventer and Stripper.

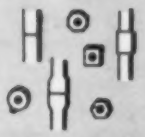
HERE'S a unit that maintains *continuous* pressure control as long as the drill string is in the hole—whether the string is rotating, is being raised or lowered, or remains stationary. Since pressure control is continuous, emergencies can't happen too fast for this unit, because it is *always* sealed off around the drill string until the string is removed from the well. Note the many unusual features as outlined below...



Note space-saving compactness. Even flow-line connections are built-in, eliminating need for spools.

PRESSURE SEAL IS CONTINUOUS—not only while running the varying shapes of the drill string in and out of the hole, but also during rotation and while pipe is stationary. Moreover, the sealing unit automatically adjusts itself to maintain its seal. No manual operations are necessary!

PROTECTIVE STEEL BARRIER of flexible latches protects the Stripper Rubber against damage as varying shapes and diameters pass through the unit. This flexible steel barrier also protects the Rubber from extruding under high well pressures!



SEALS VARYING DIAMETERS AND SHAPES because the Stripper Rubber *automatically* expands and contracts to maintain a pressure-tight seal around the elements in the drill string—the varying diameters of flush, upset and coupled pipe, drill collars, subs, etc.... and any shape kelly, whether square, hexagon or octagon!

SEPARATE THRUST AND RADIAL BEARINGS carry all rotating loads, assuring maximum efficiency under any combination of horizontal and vertical loads. And since the Stripper Rubber rotates with the kelly—not around it—wear and flexing of the Rubber is negligible and the seal remains pressure-tight!

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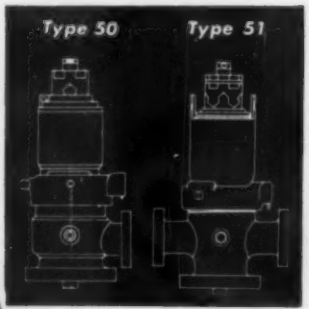

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Both types have the same basic design advantages!

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THE ALASKAN OIL QUEST is on in force. As in any new region, surface geology comes first. But seismic crews are close behind. The whirlybird is a faithful steed.

Alaska: A glittering new frontier

BY FRANK J. GARDNER

WHY ALL THE FUSS about Alaska? It's been with us for more than 90 years. It produced oil as early as 1903. It's always been considered a good oil prospect. Yet the "boom" there is only 2 years old.

Several things have caused the explosion of Alaskan interest. Among them: the Richfield Oil Corp. discovery at Swanson River in 1957, the release of the U.S. Navy's reports on its work on the Arctic slope, the decline in domestic discovery rates, an increasing wariness of foreign operations, and statehood. There are other factors involved, but these five were enough to draw the industry northward to the new state.

In this annual exploration number of the Journal, we have tried to present the real picture of what awaits the oil hunter in Alaska. No author in this issue has written with rose-colored glasses astride his nose. Nor has any author peppered his words with gloom. The plain fact is that Alaska is still a big question mark for the industry. One conclusion can be drawn: the positive factors definitely outweigh the negative. One observation can be made: the positive factors fall within the realm of economics and geology; the negative factors are almost entirely physical. With such a combination as this, only one prediction can be made: big oil is there, and it will be found.

On the plus side, what do we find? First and foremost, the geology of Alaska, still little known, is the geology that has always favored major oil and gas fields. Nine major basins are known today. Others may emerge. The five requirements for oil accumulation are fully satisfied: ample and favorable sediments, known unconformities, wedge porosity belts, folding and faulting, and evidences (in this case, actual existence) of oil and gas.

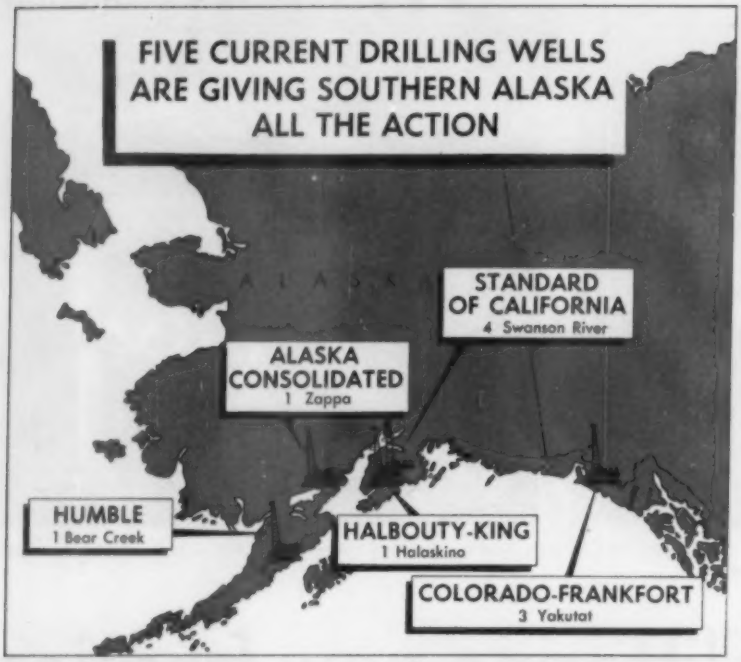
Challenges Are Great

More important, here is an enormous near-virgin oil province that stands unique in oil history . . . it's never been condemned as hopeless. Nearly all great oil provinces of today have at one time or another been condemned by some prominent if sadly misled geologist. Another distinction for the state: never before has such a large and promising prospect been attacked on every flank by an oil industry with such a formidable array of highly scientific finding tools.

On the economics side, the odds are favorable again. Operators feel that a ready market will develop for Alaskan oil, on our West Coast and in Japan. Pipelines will materialize, and soon, following discovery. Reserves to be found are large, and at a low cost per barrel. Alaska offers us a new opportunity to put domestic reserve additions well ahead of withdrawals—an essential item in view of a constantly growing domestic demand. The cheapest methods of discovery can be employed, or the most expensive—take your choice. But the most important of all, operations in the good old American way of free competitive enterprise lie in wait in Alaska.

The disadvantages of Alaska accentuate the physical. And the oil industry has an enviable reputation for conquering barriers. Weather, darkness, terrain, transport, and supply present no challenge to a business that has met and mastered them all before. There are, of course, economic disadvantages as well; but the high costs of exploration will shrink here with success, as they have done in other regions. The recent abandonment of Humble Oil & Refining Co.'s Bear Creek wildcat (too recent to be recited in other articles in this issue) is a gold-plated illustration of these costs; millions of dollars went into that dry hole, but will it deter Humble in its search? Definitely not. The hope for success will drive this operator on, as it always has.

Today, independent and major are drilling side by side in Alaska. The campaign shows every sign of acceleration in the coming months. This program cannot wait. That's why the fuss about Alaska.



Accessibility is key to present Alaska drilling

BY WILLIAM T. SMITH
District Editor

WHILE it's a pretty safe bet that the combination of an oil discovery and the advent of statehood is spurring drilling in Alaska, it's an equally safe bet that there won't be a torrent of rigs heading northward in the coming months.

Opinions on Alaska's long-range prospects usually fall into one of two general categories. They are:

. . . There are many areas there with great promise due to favorable geologic evidence.

. . . There are many areas there with great promise due to the lack of unfavorable geologic evidence.

It's a fine point. You pay your money—and in Alaska's case, big money—and take your choice. As is the case with opinions, the music is as important as the words.

The geologist expressing the first opinion does so with enthusiasm. The geologist expressing the latter opinion does so with a shrug of the shoulders.

There's also evidence of a direct relationship between whether or not the geologist expressing the opinion is working for a company looking for a joint-operation deal on its holdings in the new state. That is the one trend that definitely appears to have formed —that companies are going to go the joint-operation route as much as possible.

Actually, for one of the biggest reasons for Alaska's current attractiveness, you have to look halfway around the world. The Alaskan activity reflects in large measure the industry's awareness that world conditions dictate an urgent need for a major oil supply west of the Suez.

First looks . . . Naturally, the areas of the most encouragement are getting the first look. In general, these include southern Alaska from Bristol Bay on the west to Yakutat region on the Gulf of Alaska to the west. Included in this area are Cook Inlet, Kenai Peninsula, and the Katalla-Yakataga area.

Taking them in order, from west to east, this is the picture:

. . . Bristol Bay. General Petroleum Corp. recently announced plans to spud in a wildcat on 1,000,000 acres held by a number of smaller oil companies on this Alaska Peninsula region. General Petroleum and Great Basins Petroleum Co. conducted extensive joint geological and geophysical surveys on these holdings last summer.

The attraction here is that sediments around the periphery of the bay correspond to those found on the Swanson River unit on Kenai Peninsula more than 200 miles to the northeast.

This is also one of those areas described by some geologists with a shrug as favorable because "there are no unfavorable rocks present."

Other companies with holdings involved in this deal include Ambassador Petroleum Corp., Hudson Gas & Oil Co., and Republic Natural Gas Co.

. . . Bear Creek Unit. This 650,041-acre unit is located on the Cook Inlet side of the Alaska Peninsula. Its main claim to fame currently is that it boasts the state's deepest well drilled to date. Humble Oil & Refining Co. stopped drilling at 14,375 ft. on 1 Bear Creek Unit in the Puale-Wide Bay area northeast of Kanatak. Humble originally planned to take this well only to 12,500 ft. It is one of three Humble plans to drill in order to gain a 50% interest in 260,000 acres held by Shell Oil Co. in the unit.

. . . Iniskin Bay. Drilling in this region on the west side of Cook Inlet across from Kenai Peninsula dates back to 1936. At that time, Iniskin Unit Operators, Inc., drilled a well which reported subcommercial production briefly before it was abandoned in 1939. Crude produced was of high enough gravity that the operators used it as fuel in company trucks.

After World War II, Russell Havenstrite, Los Angeles, took over the Iniskin Unit operations, spudding in a wildcat ½ mile south of the earlier test. This well reported good shows at 6,300 and 8,200 ft. Operations were shut down when winter set in in 1957 with the well at 9,747 ft. The intention was to resume drilling in 1958. However, Havenstrite died in March 1958, which halted operations until July when Alaska Consolidated Oil Co. took over Havenstrite's interests.

The day after Christmas, 1958, Iniskin Unit Operators, with Alaska Consolidated running the show now, spudded in a third wildcat on the unit ½ mile southwest of Havenstrite's suspended well. This latest test, 1 Antonio Zappa, was drilling ahead below 3,075 ft. The attraction here is an anticline extending 10 miles in a northwest - southeast direction and ranging from ½ to 1 mile wide.

. . . Cook Inlet. This narrow stretch of water, which divides Kenai Peninsula from the Alaska Peninsula and extends up to Anchorage, is slated to get a seismic going over this spring. Four marine seismic vessels, part of a seven-vessel fleet, were due in Homer early this month to start a 10-company joint program with Standard Oil Co. of California as operator. Object of this project is to provide each of the participating companies with enough

SWANSON RIVER 2 unit, second producing well on the Kenai Peninsula of Alaska. The well was completed by Standard Oil Co. of California, Western Operations, Inc., flowing approximately 500 bbl. daily. Standard is operator of the Swanson River unit for itself and partners Richfield, Union, and Ohio oil companies.

preliminary data to make individual appraisals of the inlet's oil possibilities. The other companies besides Standard of California are Ohio Oil Co., Pan American Petroleum Co., Shell Oil Co., Sunray Mid-Continent Oil Co., Superior Oil Co., The Texas Co., Union Oil Co. of California, Western Gulf Oil Co., and Richfield Oil Corp.

At the west end of the inlet just northwest of Anchorage, Union Oil and Ohio Oil last month were granted leases covering 229,000 acres in the Knik Arm area. The 4-year pact calls for the two companies to spend at least $450,000 and drill three wildcats.

. . . **Kenai Peninsula.** With the state's only major oil discovery in recent years, this region currently is the champion attention getter.

Touching off interest on the peninsula was a major oil strike by Richfield Oil Corp. in the summer of 1957 on the 71,680-acre Swanson River unit in the National Moose Range.

Shortly after the 900-bbl.-daily discovery of 1 Swanson River unit, Richfield and Standard of California signed an agreement pooling their interests on the peninsula. The deal called for Standard of California to spend $30,000,000 exploring its and Richfield's holdings on the peninsula. For this, Standard took over as operator and got a 50-50 split of Richfield's 89% interest in the productive Swanson River unit.

Richfield was drilling a second test on the unit 2 miles south of the discovery when the agreement with Standard was signed. This second test, 2 Swanson River, was suspended at 12,046 ft. and the rig moved 50 miles southwest to the 250,000-acre Deep Creek unit at the southern end of the peninsula.

After drilling a 14,221-ft. dry hole at Deep Creek, the rig was moved back to Swanson River where it drilled and abandoned the 11,653-ft. 3 Swanson River 1 mile northeast of 1 Swanson River. Standard next went back into the suspended 2 Swanson River, dually completing it for 500 bbl. daily in the Hemlock zone found in 1 Swanson River, and a deeper zone 150 ft. below the Hemlock. The perforated intervals in 1 Swanson River are 11,131-70 ft. and those in 2 Swanson River are 10,804-89 ft. and 11,038-60 ft.

At the present time, production from the two wells is trucked to Seward and tankered from there to California.

Currently, Standard is drilling ahead below 10,269 ft. on 4 Swanson River about 1½ miles southwest of the discovery. In addition, sites for 5 and 6 Swanson River have been announced ⅝ mile northwest of the discovery and ¾ mile southwest of 2 Swanson River, respectively.

On January 31, another group began drilling on Kenai only 4 miles south of the Swanson River unit. This latest test is on a 2,240-acre farmout by Alaska Oil & Mineral Co. to King Oil Co. Wichita Falls, Tex., and Halbouty Alaska Oil Co., Houston. It was drilling ahead below 4,533 ft. The test is labeled by the operators a 10,000-12,000-ft. wildcat, but the rig is rated to 15,000 ft. and indications are it will be taken down below that depth if conditions warrant. The Hemlock sand is the main objective. The two companies have a similar deal on another 3,300 acres in the vicinity and Halbouty has a 30,000-acre lease elsewhere on the peninsula.

In addition to the active drilling projects listed, Standard of California has ordered a deep-rated rig for a second test of the Deep Creek Unit some time early this year.

Katalla-Yakataga . . . Richfield earlier this year was awarded a 490,000-acre development contract in the Katalla-Yakataga region about 100 miles southeast of Anchorage on the Gulf of Alaska. Richfield also has on file an application for an additional 571,000 acres in the same area.

It's interesting to note that these two parcels were part of a 1,000,000-acre block relinquished by Phillips Petroleum Co. Phillips spent several million dollars on the parcel, including two deep tests and a strat test. Both the deep tests, of which one went to 12,054 ft., found noncommercial shows.

The Richfield holdings are about 50 miles southeast of Cordova, scene of Alaskan production dating as far back as 1902. The small field at Katalla was abandoned in 1933 when a small refinery there burned down.

Southeast of Richfield's new lease block, Colorado Oil & Gas Corp. was redrilling at 10,848 ft. on its third wildcat on some 1¼ million

acres it controls in the Yakataga district. Colorado's partners in this venture are Frankfort Oil Co. and Continental Oil Co.

Other prospects . . . In addition to their favorable, or lack of unfavorable, geology, the areas currently being drilled have the added advantage of being the most accessible and having the mildest climate. Of course, with one-third of the state above the Arctic Circle, "mildest climate" is a relative term.

However, they are by no means the only areas under consideration. The Federal Bureau of Land Management offices in Anchorage and Fairbanks report that leases have been filed on nearly 45,000,000 acres of federal lands in the new state. Anchorage is processing 1-year-old applications while Fairbanks is about 10 months behind schedule. When the new state came into being, the federal Government turned over nearly $4,000,000 in rental funds on federal lands. This amount accrued from July 7, 1957, only.

In the months and years ahead, such names as the Copper River basin, Matanuska Valley, Porcupine basin, Yukon-Kuskowin River Valley, South Gubic anticline, Koyukuk River Valley, and other places will be heard from.

Two projects currently under consideration which could spur drilling in the arctic regions of Alaska are proposed gas and crude pipelines from the Naval Petroleum Reserve and Gubic gas-field regions of the Arctic Circle south to the Yukon region through Anaktuvuk Pass of the Brooks Range.

Two major obstacles stand in the way of extensive drilling operations there. One is the weather with everything north of the Pribiloff Islands and Bristol Bay having arctic conditions. Point Barrow at the top of Alaska is ice-locked 10 months of the year.

About the only areas ruled out as oil prospects are the Aleutians and the so-called Panhandle region of southern Alaska. The former is volcanic while the latter is characterized by hardened mineralized rocks and is badly faulted.

GEOLOGISTS of Union Oil Co. of California trek over the rugged Alaskan terrain, joining the rapidly increasing march into the new state's many possible future petroleum provinces.

New Mexico wildcat gets Penn-Devonian pay

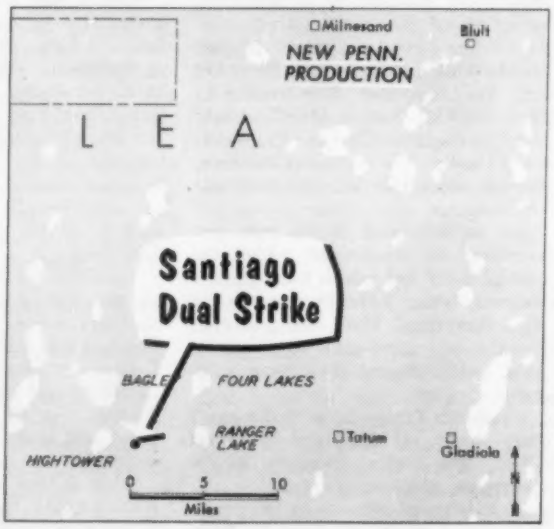
THE TATUM AREA of Lea County was in the news again last week. Santiago Oil & Gas Co. 1-30 State, in NW NE 30-12s-34e, has been completed as a dual strike, in the Pennsylvanian and in the Devonian.

On potential tests the well flowed 45° oil at the rate of 288 bbl., based on a 4-hour test through 18/64-in. choke. Flowing pressure was 450 psi., with gas-oil ratio of 475:1. Perforations at 10,218-36 and 10,250-58 ft. were washed with 500 gal. of mud-acid and treated with 3,000 gal. of regular acid.

Second pay zone was the Devonian at 12,899-12,924 ft. After 500 gal. of mud-acid and 10,000 gal. of regular acid, the flow was calculated at 9,500 M.c.f.d. of gas, plus 55.4 bbl. of 62° condensate per 1 M.M. c.f.

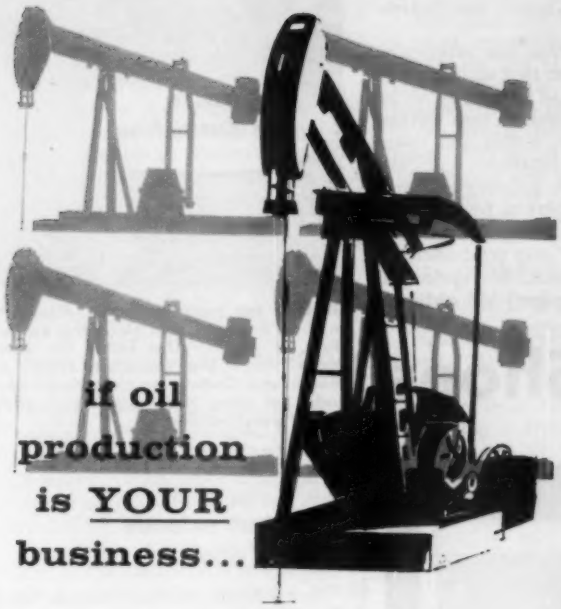
Location of the new producer is 13 miles west of Tatum and 2¼ miles east of Devonian and Pennsylvanian production in Hightower field.

Len G. McCormick and associates, Midland, are operators of the well when it was spudded, incorporated as Santiago while it was drilling.



SANTIAGO'S STRIKE is east of similar production in Hightower field. The new Pennsylvanian production, upper right on the map, is Ohio Oil Co.'s 1 McGrail-Federal. Ohio's pool opener flowed 720 bbl. a day from pay at 9,490 ft.

Phillips Petroleum Co. has started its 1 Signal as a northwest offset to the Santiago discovery.



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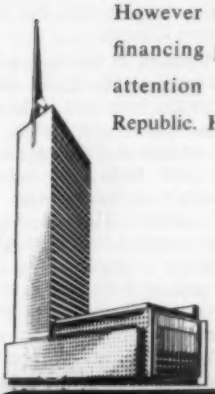

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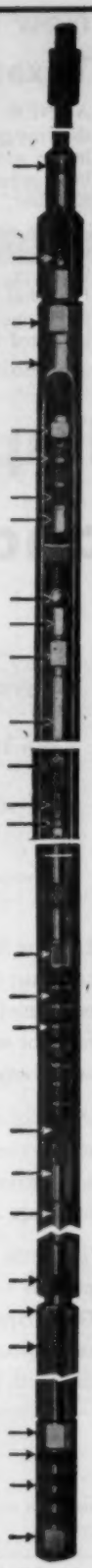

Figs. 600-800-900

New map shows Texas Panhandle

A NEW wall-size geological map showing pay formations for each well in the northeast Texas Panhandle has been published by the Panhandle Oil Explorer, Box 3193, Amarillo.

Map shows all wells and fields in the counties of Hansford, Hutchinson, Ochiltree, Roberts, Lipscomb, and Hemphill. Field names are shown and producing horizons in each well are indicated by symbolic coding.

Subdivisions of the following major geologic horizons are used to indicate producing pay in each well: Wolfcamp, Virgil, Missouri, Des Moines, Atoka, Morrow, Chester, and Granite Wash.

The map is a blue line print from a film base, drafted to a scale of 1 in. to 8,000 ft., over-all size 40 by 60 in. It shows acreage division into section, block, and survey. Cities and towns are shown in true location.

It is suitable for coloring and may serve as a wall display or for use as an up-to-date reference map on the area. The only pay-zone map yet drafted for the Texas Panhandle, it is priced at $25 per copy on paper, $35 on linen.

HERE IS the most important discovery in the Paradox basin since the earlier days of Aneth. The Texas Co. completed its 1 Ute Mountain Tribal in Montezuma County, southwestern Colorado, for more than 1,200 bbl. daily from Pennsylvanian.

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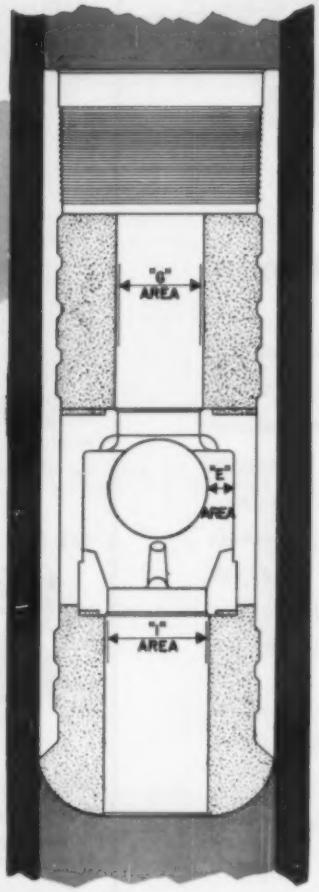

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Ohio test extends Gratiot pool

In a 3-hour test after fracture, Natol Corp. reported the 2 R. W. Rambo, Section 21, Hopewell Township, Licking County as having made 100 bbl. oil.

This completion, a stepout north in Gratiot pool, logged the Clinton sand at 3,110-42 ft. and 3,149-61 ft. with a show of oil and gas natural.

Alberta hot spot surprises oil men

SIMONETTE RIVER—Alberta's major oil strike last year—is currently causing mixed feelings within the industry of western Canada.

Major development in the region is a 2½ mile stepout to the initial discovery well that has indicated a thicker-than-expected pay sector; while a well that was expected to be a sure thing, only 1 mile from that initial strike, is reported to have found a very thin pay sector. This development is being carried out entirely under the direction of Shell Oil Co. of Canada, Ltd. and as well as the two wells that recently reached the D3 reef pay zone, has another pair of wells in the same vicinity currently nearing the hoped for productive horizon.

It will be recalled that the initial discovery well in this region, which lies about 160 miles west northwest of Edmonton, Shell-Petrol-Explorers 12-9-63-25 Simonette found a 100-ft. net pay sector in the Devonian reef sector. It was completed with an initial potential of 528 bbl. of light

gravity oil daily and then Shell got down to business. Four rigs were moved to the area and each is boring a 12,000-ft. hole. It is hoped that the rigs, after completion of the current development, will be moved on to new sites in the region.

The major development in the area was recorded at the Shell-Petrol-Explorer 10-1-63-26 Simonette hole, on LSD 10, 1-63-26w5. That 2½-mile southwest stepout test found the productive reef horizon some 90 ft. higher than the depth at which it was encountered in the discovery hole and net pay figures of up to 200 ft. have been forwarded. That, however, will not be known until the well either tests or is logged at the expected water-table level.

Only one drill-stem test has so far been conducted in the hole. It covered a 35-ft. interval below 11,456 ft., 10 ft. below the horizon's top, and a recovery of 1,200 ft. of oil and 500 ft. of drilling mud was taken from the pipe. While it does not seem as prolific as the discovery hole that flowed oil to surface from the initial test in the top of the same formation, it is thought that a dense section was encountered in the stepout that did not occur in the discovery well and in fact only 6 ft. of actual porosity was taken in by the evaluation test.

The disappointment, meanwhile, is Shell-Petrol-Explorers 10-5-63-25 Simonette on LSD 10, 5-63-25w5. It is only 1 mile south southwest of the initial strike, and although nothing has been released officially on it, rumors state that it failed to find the reef at a favorable elevation and at best, will only contain 35 ft. of net pay. It is thought, however, that it will still prove productive, but production tests will have to be run before that will be known.

Whatever happens at the new holes, on the basis of the major stepout success, it has been estimated that 30 locations have been proved by the discovery and the stepout. That is, taking into account the depth at which the wells encounter production, that it will be set up on the basis of 160-acre spacing.

Like the discovery hole, the development to date has taken place on acreage that Shell acquired under farmout agreement from the team of Central Explorers, Ltd. and Petrol Oil & Gas Co., Ltd. That team farmed out two separate petroleum and natural-gas reservations to the major company and in return each retained a 7½% net carried interest in the entire tract and a 25% working interest in every northwest quarter section that Shell converted to petroleum and natural-gas lease.

Montana's Stensvad stretches south

Montana's new Stensvad field added a good extension strike. McAlester Fuel Corp. 2-A Montana-Federal, SW SW 12-11n-31e, Rosebud County, flowed 36 bbl. of oil in 1 hour on ¾-in. choke from perforations in lower Tyler at 5,356-76 ft.

This new well is a south extension to Stensvad field. There are two other active wells in the area.

Busy drillers hit in North Dakota

Spirited development drilling in North Dakota's South Rival field turned up a 228-bbl. per day well. Pan American Petroleum Corp. completed the 1 Huttner-Bank of North Dakota in NE NE 27-163n-92w, Burke County, for 228 bbl. per day on 10/64-in. choke. Production is from Nesson Mississippian at 6,149-67 and 6,172-81 ft. This is a north extension to South Rival field.

Pan Am is busy at three other wells in this field.

Action seen in Illinois' Wayne County

One of Illinois' fine new producing areas is located in Wayne County, 1 mile north of Burnt Prairie. Five producers have been completed since last November.

The discovery well was Alva C. Davis 1 Winzenburger in NE NE NW 18-3s-9e. It pumped 110 bbl. daily from Rosiclare at 3,384-91 ft. Several wells are active in the area now.

New Brunswick well abandoned

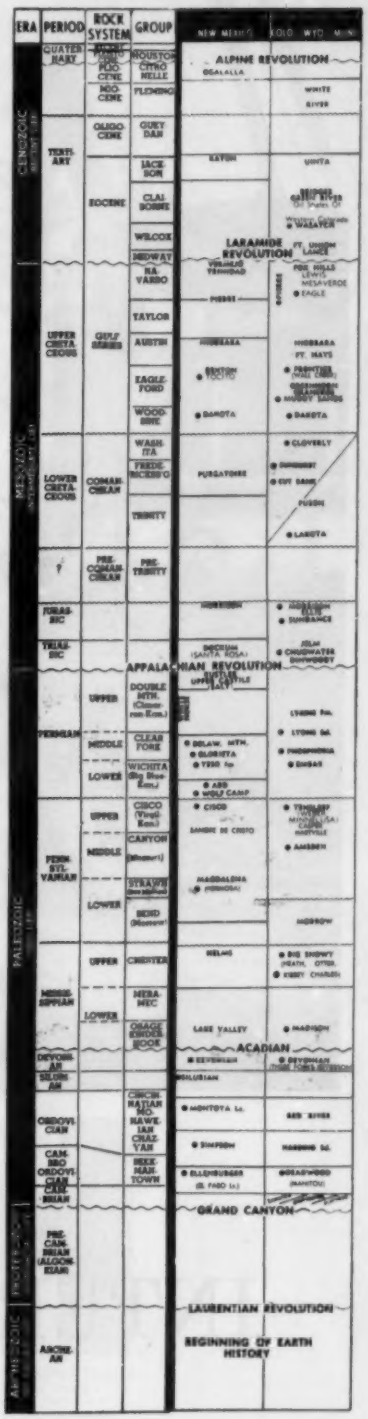
IN EASTERN CANADA Imperial Oil announced it had abandoned one exploratory well in New Brunswick and would begin to drill another.

The rotary drilling rig which the company brought to the Maritimes from western Canada will be moved from its first New Brunswick location near the town of Hillsborough to a new site near Berryton, 15 miles west.

The Hillsborough well, which was part of a drilling program carried out in partnership with New Brunswick Oilfields, Ltd., was drilled to a depth of 3,794 ft. before it was abandoned as a dry hole. The rig is now being dismantled, and will be moved by truck to Berryton. Drilling of the new well, to be known as Imperial New Brunswick Oilfields 1 Berryton, will start in March.

The company is also operating a cable tool rig in New Brunswick. It is now drilling at a depth of 705 ft. near St. Josephs.

Correlator Rocky Mountain



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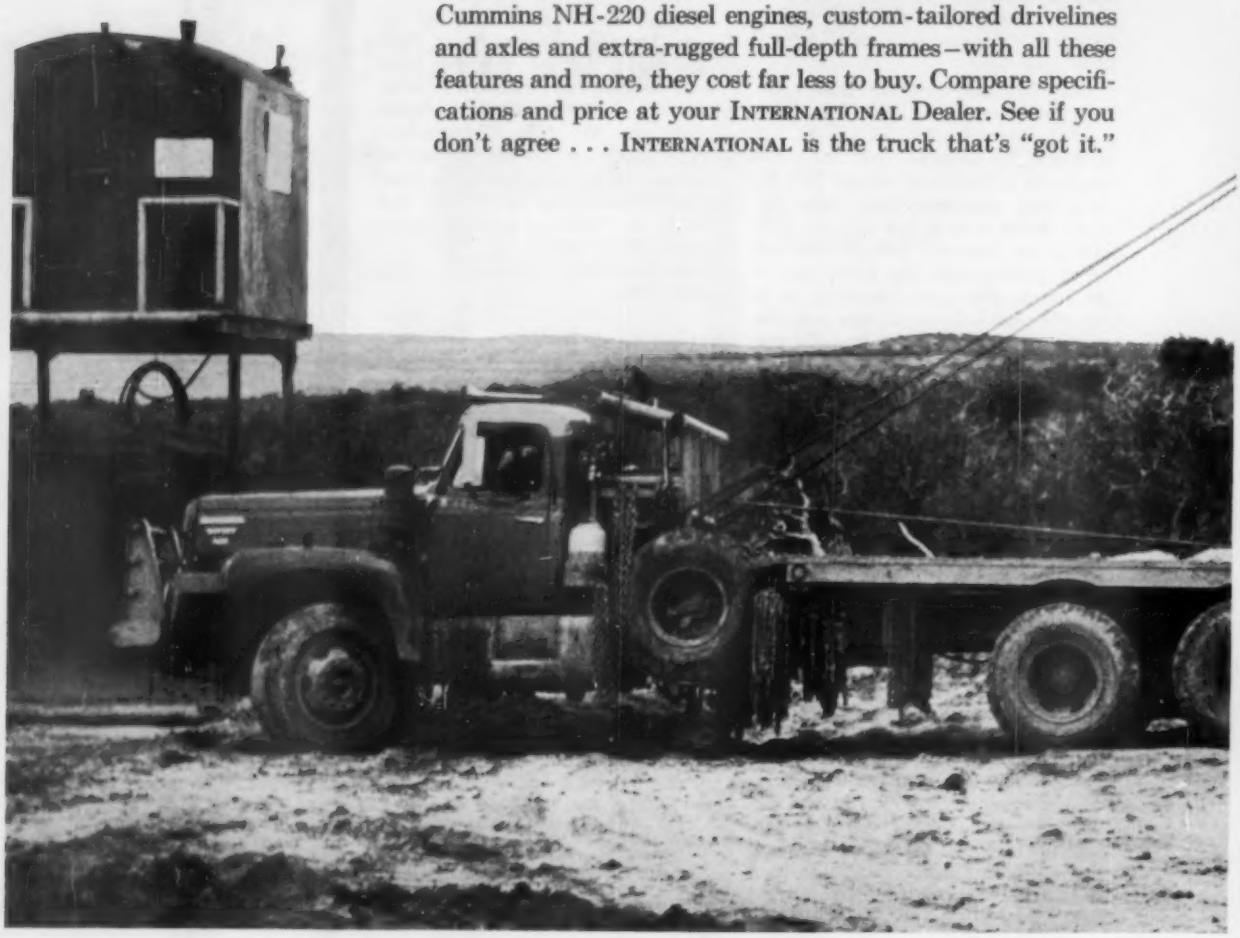

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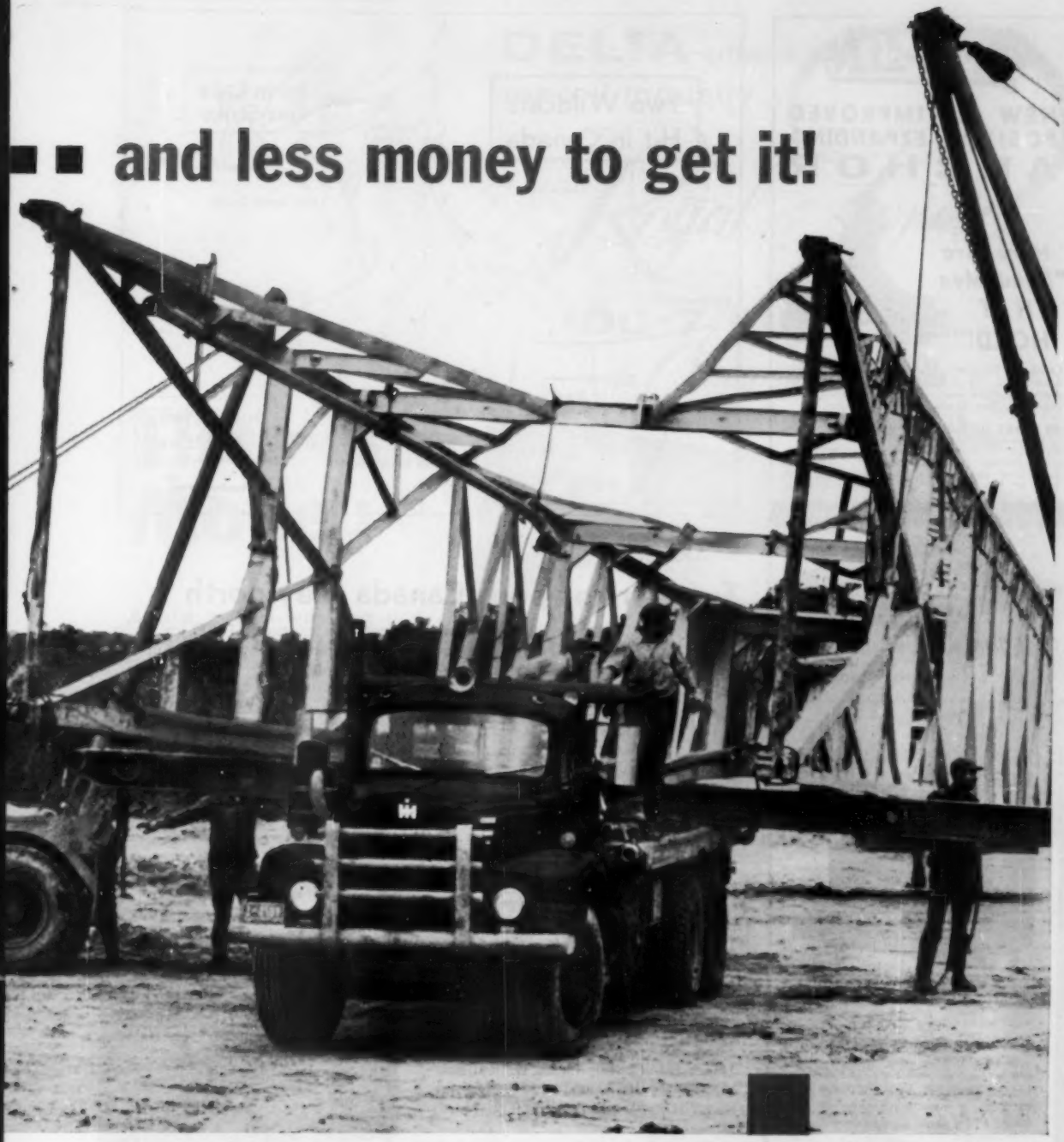

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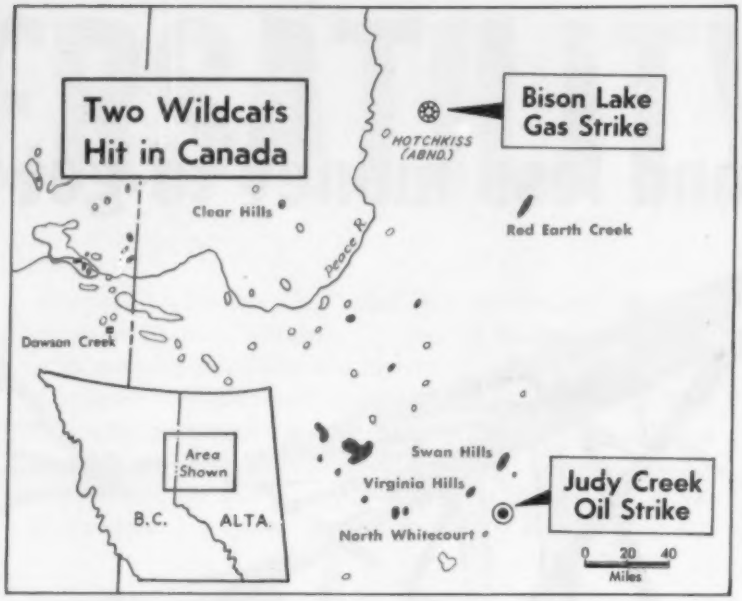

In Alberta

Twin strikes push Canada play north

DISCOVERIES in two different areas of Alberta may push gas production another step northward and extend the oil play in the Swan Hills region.

The gas discovery is Honolulu Oil Corp. and Texaco Exploration Co.'s Bison Lake wildcat about 60 miles northwest of nearest production in Red Earth Creek field and 80 miles northeast of Clear Hills field.

The well flowed 12,100 M.c.f. of wet gas daily from perforations in the Gilwood sand at 4,738-48 ft. Operators are drilling ahead to granite. The new discovery, in LSD 10, 12-95-15w5, is about 25 miles northeast of the abandoned Hotchkiss gas field, which had produced from another formation.

Swan Hills . . . The oil discovery is Imperial Oil's Judy Creek wildcat near the center of a triangle formed by Swan Hills, Virginia Hills, and North Whitecourt.

The well, in LSD 16, 31-63-10w5, flowed 41°-gravity oil during drillstem test in the upper part of the Beaverhill Lake-Middle Devonian zone at 8,395 ft. Flow rate was not reported. The rig cored ahead after test until mechanical troubles developed.

The oil fields that surround the Judy Creek are productive in the Beaverhill Lake.

Another strike . . . A major discovery in northern Alberta with a flow potential in excess of 1,000 bbl. daily also was reported by Union Oil Co. of California.

The discovery, 10-14 Eaglesham, is

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currently producing 240 bbl. daily of clean 38°-gravity crude through a restricted choke. Production is from the Normanville reef at 7,605 ft. The test also encountered three shallower Cretaceous gas sands en route to the oil zone. Nearest Normanville reef production is 20 miles northeast.

Union's wildcat was drilled on the southern part of a 60,000-acre lease block held jointly with Hudson Bay Oil and Gas Co. Union and Hudson previously had completed a gas discovery 6 miles north of the new oil discovery.

Swan Hills oil extension proved

A 3-MILE NORTHWEST extension of the prolific Swan Hills oil field has been proved in tests announced by Home Oil Co.

The vital well, D-10-17, in tests flowed at the rate of 41 bbl. an hour through a 20/64-in. choke from the Beaverhill Lake formation.

The Swan Hills field now has indicated length of 13 miles from north to south and a maximum width of 7 miles.

Following its original discovery, Home extended the field 5 miles southwest, then 6 miles directly south of the discovery.

The team of Pan American and British American then completed a well 12 miles south of the discovery and early this winter, confirmed the southern extension of the field in a producer 2 miles south of Home's southernmost well.

Sarah Lake test has prolific flow

IN ALBERTA The British American-Pan American 2-13 Sarah Lake wildcat, located at LSD 2, 13-65-11w5, has flowed oil to the surface at a rate of 695 bbl. per day during a drill-stem test in the Swan Hills member of the Beaverhill Lake formation.

The discovery well is situated approximately 110 miles northwest of Edmonton on a 92,160-acre reservation owned jointly and equally by British American Oil and Pan American Petroleum Corp. Significant oil discoveries have been recently recorded both immediately north and south of the B-A Pan American reservation.

In the first drill-stem test at the Sarah Lake well the valve was open 2 hours and 45 minutes. Gas reached the surface in 13 minutes; oil to the surface in 65 minutes. Oil flowed for 100 minutes at an average rate of 695 bbl. per day. Gas-oil ratio was 745. Pipe recovery was 1,695 ft. of oil and 180 ft. of oil-cut mud. Corrected gravity, 39.7°.

Located in this same reservation, approximately 8 miles northeast and 10 miles north northeast of the Sarah Lake discovery are the recent B-A Pan American Beaverhill Lake discoveries at 2-13 Morse River, in LSD 2, 13-66-10w5 and A-1 Swan Hills, at LSD 14, 3-66-10w5.

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Here are state-wide spacing rules for U. S.

New Mexico

Wildcat wells must be located on a 40-acre tract 330 ft. from boundary of tract, such tract being a U. S. Public Lands Survey quarter-quarter section or lot; except in San Juan, Rio Arriba, and Sandoval counties when projected to known gas-producing horizon well shall be located on a 160-acre tract which is a U. S. Public Lands Survey quarter section and shall be 990 ft. from tract boundary with a permissible plus or minus 200 ft. tolerance, provided further, such well shall not be closer than 130 ft. to any quarter-quarter section or subdivision inner boundary.

Oil wells within a defined pool must be at least 330 ft. from boundary line of 40-acre tract which is a U. S. Public Lands Survey legal subdivision or a governmental quarter-quarter section or lot, and at least 660 ft. from nearest well drilling or capable of producing from same pool.

Gas wells within a defined pool shall be located on a 160-acre tract which is a U. S. Public Lands Survey legal subdivision or a governmental quarter section or lot, and not closer than 660 ft. from boundary of tract nor closer than 330 ft. to any quarter-quarter section or subdivision inner boundary, nor closer than 1,320 ft. from a well drilling to or producible from same pool; except in San Juan, Rio Arriba, and Sandoval counties where spacing listed under wildcat wells applies.

North Dakota

Oil wells must be located on governmental quarter-quarter section or lot of not less than 36 acres, and shall be at least 500 ft. from boundary of such tract and at least 1,000 ft. from nearest well drilling to or producible from same pool.

Gas wells must be located on a U. S. Public Lands Survey 160-acre tract or governmental quarter section of at least 145 acres, and not closer than 1,000 ft. from boundary of tract or quarter section, nor closer than 1,500 ft. from nearest well drilling to or producible from same pool.

Utah

Minimum of 500 ft. from lease line or boundary of any legal subdivision comprising a governmental quarter-quarter section or equivalent lot or lots of camparable size and location, and not less than 1,000 ft. from any oil well or 4,960 ft. from any gas well.

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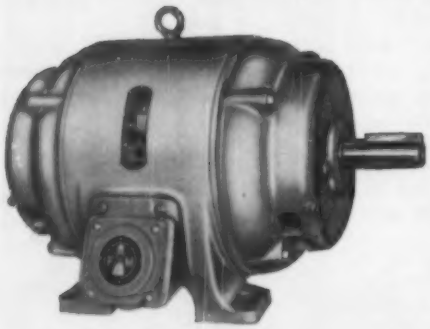

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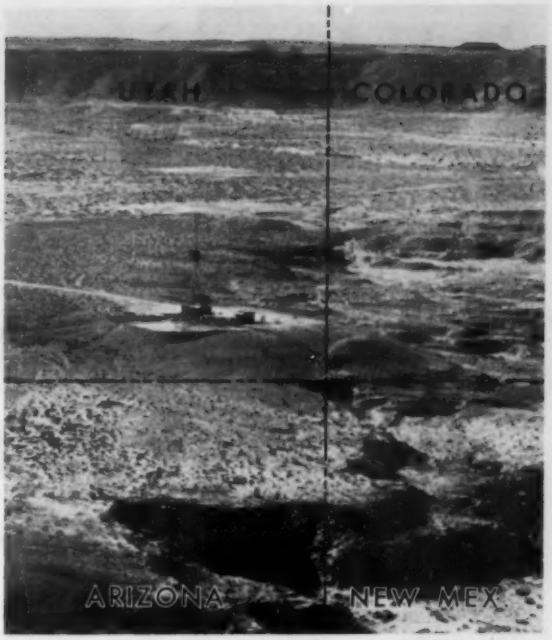
Four Corners still holds oil interest

THESE ABSTRACTS are from papers presented at the February meeting of the Rocky Mountain Association of Petroleum Geologists held in Albuquerque. This is a select group of abstracts dealing with the Four Corners region.



White Mesa Field, Environmental Trap, Paradox Basin, Utah

M. Dane Picard
American Stratigraphic Co., Durango, Colo

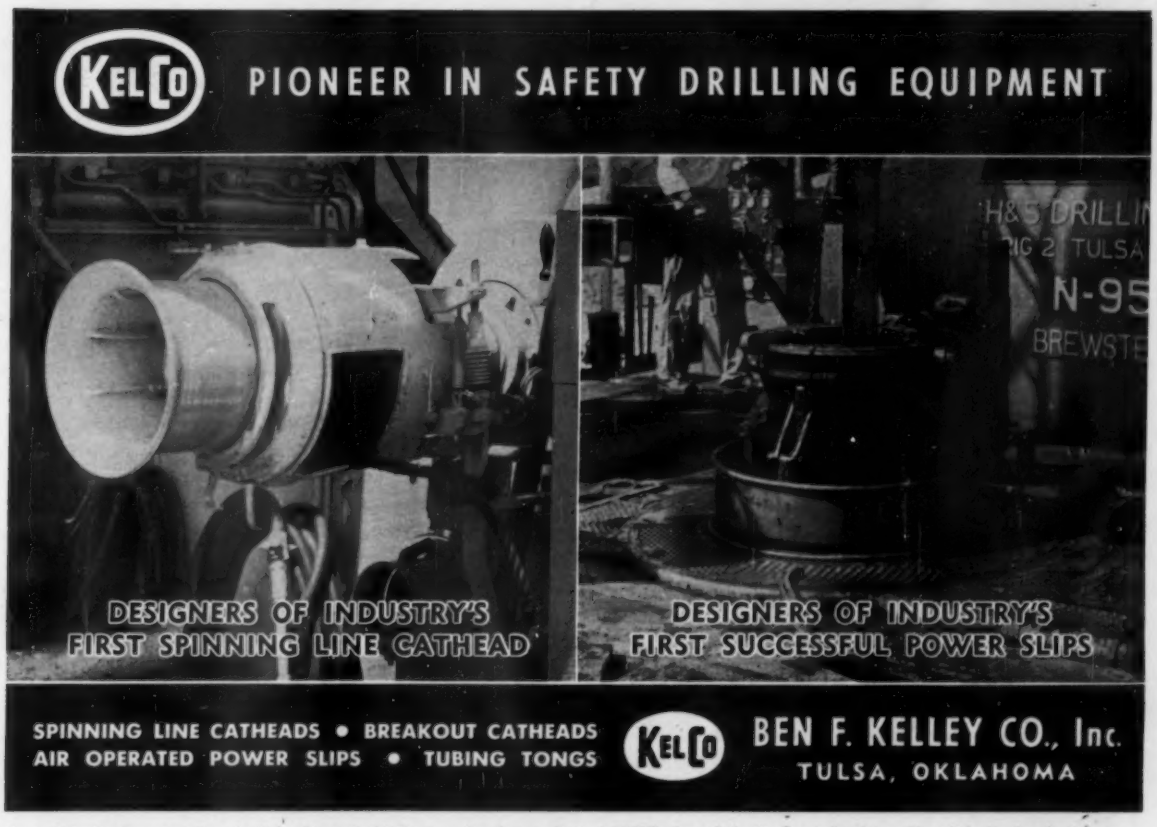
It has been said in the White Mesa field. "Every well is a wildcat." The present study indicates the situation is, perhaps, not entirely uncertain.

Located on the southern flank of the Paradox basin, the field (with one exception) produces from the Desert Creek zone of Pennsylvanian (Cherokee) age. To December 1, 1958, there were 48 oil wells.

Structurally the area can be divided into two units. The southeastern portion strikes N. 30° W. to N. 90° E. (averaging N. 30° - 70° E.), and dips gently west and north at approximately 60 to 115 ft. per mile.

In the northwestern part of the field, a small area of closure is present. This portion trends northwest-southeast, and is related to the Ratherford field northwest of White Mesa. It is separated from the southeastern portion of White Mesa by a narrow syncline opening (?) northeast.

Production in the field is from vug-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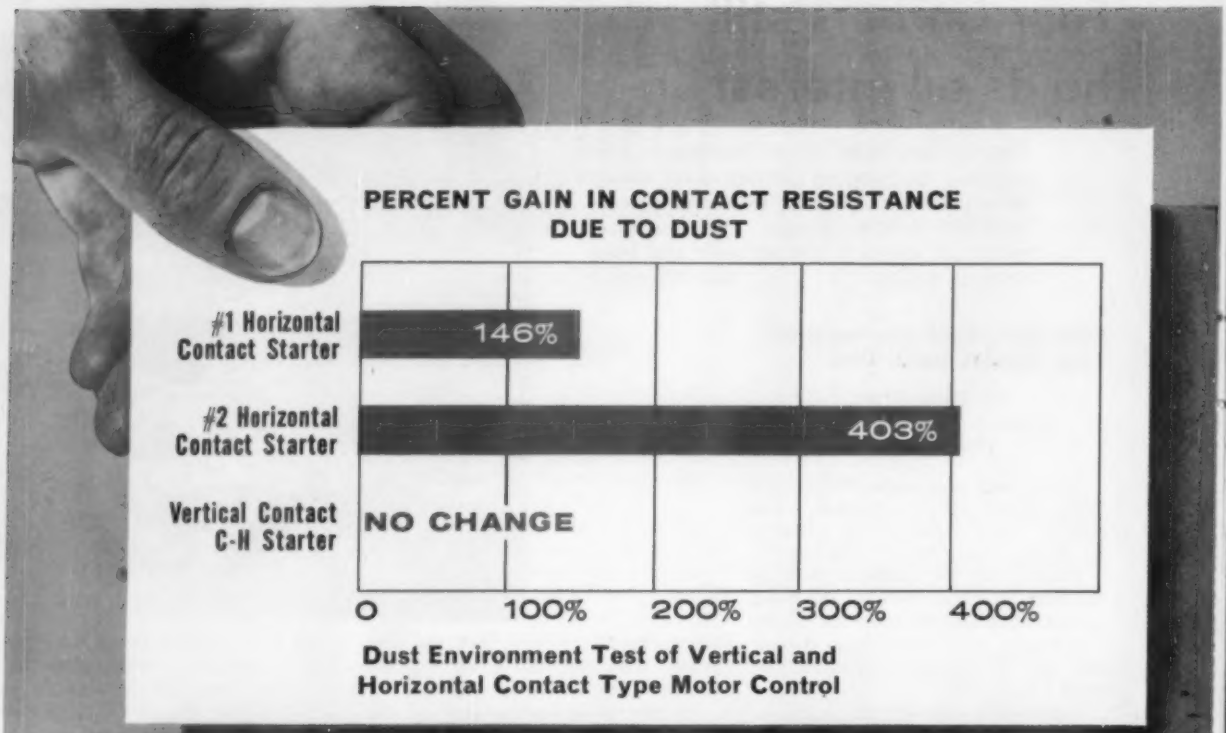

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ular, bioclastic limestone, secondary dolomite, and oolitic limestone.

The Desert Creek zone ranges from 137 to 207 ft. in thickness. It is characterized by three centers of thickening; one in the northwestern portion, a second in the northeastern portion, and a third in the southern portion of the field.

Stratigraphically the field is an area of rapid lateral and vertical lithologic change. The lithofacies pattern can be divided into three units, high-carbonate (limestone-dolomite versus evaporite more than 79%) rocks on the northern margin, similar high-carbonate versus evaporite rocks trending north-south, subsidiary to the northern unit, and a restricted lithofacies (increased evaporite) bordering the northern margin and surrounding the north-south trending carbonate lithofacies.

Because of these variations oil has been environmentally trapped. The specific change, most instrumental in entrapment, is the transition from deposits of a shallow, well-oxygenated, agitated marine environment to deposits of a deeper water, relatively quiet, restricted marine environment. The latter might be called "lagoonal."

Many wells in White Mesa produce from rocks deposited in the restricted environment; 11 dry holes have found a slightly greater environmental restriction and were not productive due to negligible permeability.

In origin White Mesa and the related fields (Aneth, McElmo Creek, Ratherford) have been called a "reef complex." The writer believes the term biostromal complex to be more descriptive of Desert Creek zone stratigraphy in the area.

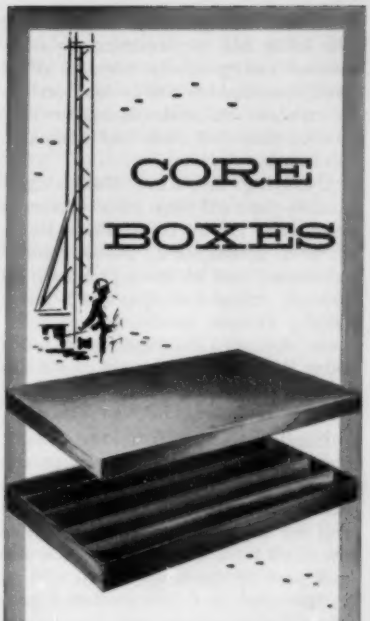
Dakota Stratigraphy in the San Juan Basin

Willis W. Tyrrell, Jr.
Pan American Petroleum Corp., Albuquerque

Subsurface stratigraphy study of the Dakota formation in the San Juan basin area of northwestern New Mexico and southwestern Colorado has been facilitated by (1) published stratigraphic sections along its outcrop, (2) good distribution and density of well control, and (3) presence of a persistent superjacent marker—the Greenhorn limestone (zone of **Inoceramus labiatus**).

The Dakota formation is the basal sandstone of an early Late Cretaceous transgression that probably reached its maximum extent in this area during latest Greenhorn time. It overlies a rather even erosion surface developed on the Morrison and Burro Canyon formations.

The Dakota may be divided into



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three units in the San Juan basin area. The lower unit is predominantly nonmarine and generally consists of a basal conglomerate sandstone overlain by carbonaceous shales that commonly contain thin coal beds and lenticular sandstones.

Overlying the basal Dakota and grading upward into the Graneros shale is a 30 to 100-ft.-thick transgressive middle unit, predominantly sandstone, that becomes progressively younger from east to west. These middle Dakota sandstones probably were deposited as near-shore sands along the westward margin of the advancing Cretaceous sea during Belle Fourche and early Greenhorn time.

Careful correlation in the subsurface and between the subsurface and outcrop sections shows the interval between the base of the Greenhorn and the top of the middle unit to be over 200 ft. in thickness in the southeast part of the basin, about 150 ft. in the southwest and northeast part, about 100 ft. in the west central part and less than 50 ft. along the west and northwest margins. These and other relationships suggest that regionally middle Dakota strand lines, unlike those of succeeding Upper Cretaceous strata, trend northeast-southwest in the southern part of the basin and north-south in the northern part.

The sandstones of the upper unit of the Dakota intertongue with the Graneros shale and are developed in one or more correlative intervals below the Greenhorn limestone. They commonly occur as lenses, are early Greenhorn in age, and have been referred to as "Tres Hermanos sandstone" in outcrop sections along the southern border of the basin and as "Graneros sands" in the subsurface.

These sandstone tongues probably represent minor regressive phases resulting from local increase in sand supply during the major Dakota transgression. The uppermost interval of widespread sandstone development occurs about 30 ft. below the base of the Greenhorn and locally is more than 50 ft. thick in the southwest part of the basin. Its distribution and northeast pinchout suggest the source of the sand was to the southwest and that by the time of its deposition regional northwest - southeast "trends" had been established.

Present Dakota production is largely from stratigraphic accumulation in the San Juan basin and from structural accumulations in the platform area along its northwest margin. The variations in shoreline trend during Dakota deposition suggests diverse orientation of trends for new Dakota discoveries.

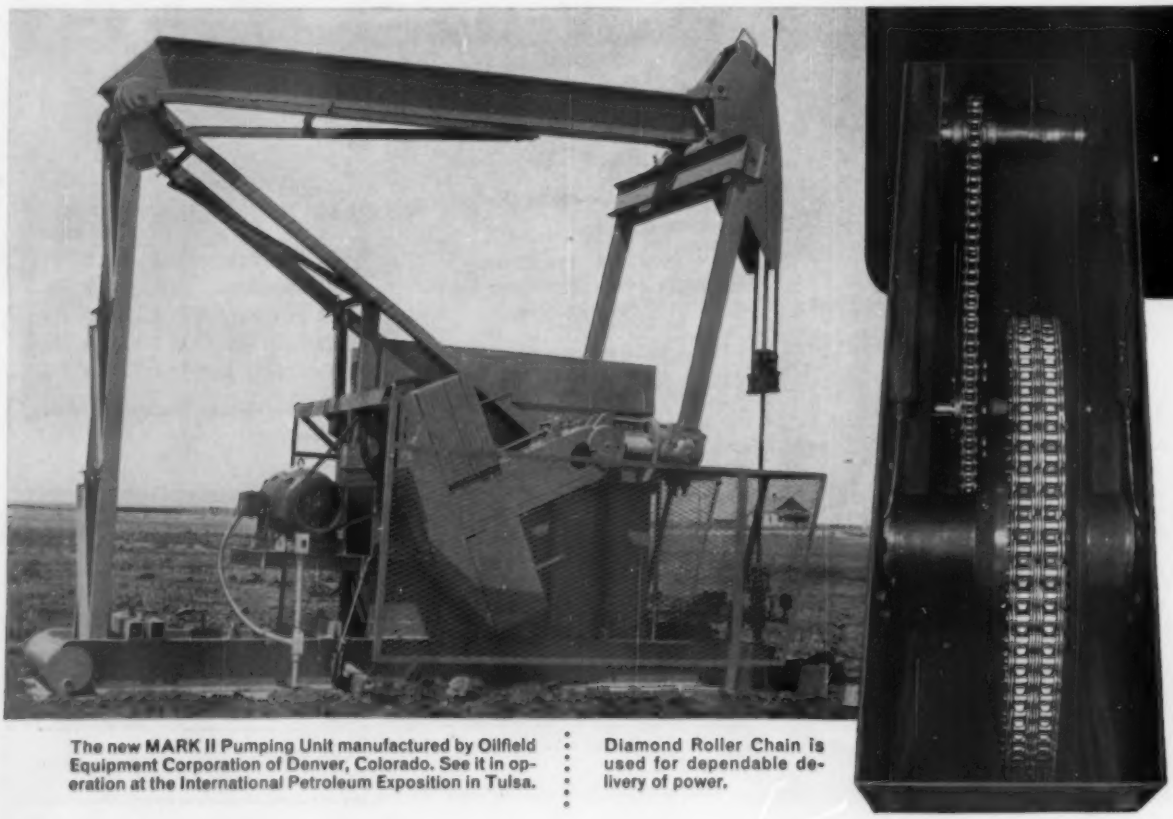
Mississippian of the Four Corners Region

Dix R. Turnbow
Walter L. Morrison & Co.,
Salt Lake City

All of the recognized tectonic features in the Four Corners region appear to be post-Humbug (Meramecian) in age and therefore had no influence on the earlier deposition of Mississippian sediments. The Mississippian system in this region is represented by the Madison, Leadville, Redwall, Humbug, and Manning Canyon formations.

The Humbug and Manning Canyon formations are present only in the northwestern part of the area, due to erosion of the Humbug and the fact that the Manning Canyon was deposited only in the area of the Oquirrh basin in Central Utah. At the close of Humbug time, strata of the Mississippian system formed the eastern shelf of the Cordilleran Miogeosyncline, and was exposed over the positive area of the southern Colorado plateau, now known as the Paradox, Black Mesa, and San Juan basins.

The possibilities of finding oil and gas accumulations in the thick, commonly porous, carbonate sediments of Mississippian age are favorable along



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the Cordilleran shelf, or hinge area. Both stratigraphic and structural conditions are favorable in this area.

The only Mississippian oil production in Utah is in the Paradox basin at the Big Flat Unit, discovered in 1957 by the Pure Oil Co. The complex, subsurface, structural conditions of the Mississippian strata, in the Paradox basin, imply excellent possibilities for oil accumulation in structural traps.

It is concluded that there is a Cordilleran shelf or hinge area in South Central Utah and that the Mississippian formations can probably be correlated throughout the Four Corners region.

Horseshoe-Gallup Field—A Preliminary Report

By William V. Knight and Harrell Budd
Petro-Atlas, Inc., and Consultant, Farmington, N. M.

Horseshoe Canyon-Gallup field, located in Townships 30n and 31n, Ranges 16w and 17w, San Juan County, New Mexico, was discovered in September 1956. It now contains approximately 90 wells.

The field produces from the Gallup formation of the Mesaverde group. The oil accumulations are stratigraphic and occur in highly localized sandstone lenses. The thickness of these lenses varies from a feather-edge to more than 20 ft. Although numerous lenses are present, they are usually referred to as belonging to one of the two sands. The upper sand, which consists of several interbeddded sandstones and shales, is the most widespread. It produces throughout the field. The lower sand is long and narrow. It seldom consists of more than two main sand bodies with thin lenses occasionally found above and below. It is found throughout the length of the field's northwest-southeast extent.

Structural information to date is quite complete and indicates that it bears only a minor relationship to accumulation.

Shallow depths and substantial reserves make this field possibly the best oil investment in the Four Corners area. Average depth is 1,400 ft. with over-all cost of approximately $20.00 per foot for a completed well.

Recoverable oil reserves per well vary due to the lenticular nature of the reservoirs; however, 3,000 bbl. per acre is average. Payout period is approximately 7 months with a 4 to 1 ratio of investment to return.

Future exploration for this stratigraphic type of Gallup accumulation should be limited to the band of deposition between the area of continuous beach sands and the seaward pinchout of the Gallup tongue. In addition fractured reservoirs with poorly developed sands could be expected throughout this band and for a short distance seaward from it.

Pennsylvanian Paleogeology and the Search for Oil in the Lucero Basin, Central New Mexico

Sherman A. Wengerd
University of New Mexico, Albuquerque, N. M.

The Lucero basin of Central New Mexico was an area of Pennsylvanian sedimentation representing a significant widening of the Central New Mexico seaway or accessway from the Paradox geosyncline on the north to the Sonoran geosyncline on the south. Several such basins along this accessway include the Lucero, San Mateo, and Orogrande, all of which have slightly different post-depositional geologic histories.

This accessway, of which the Lucero basin is a part, ranged from 50 to 130 miles in width, and received up to 3,000 ft. of Pennsylvanian sediments which form the Sandia, Madera, and

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Red Tanks formations. This seaway was in existence between Atokan and Virgilian time but was widest during Des Moinesian and Missourian time. Pennsylvanian marine sedimentation was limited on the west by the Zuni positive, on the east by a long sinuous platform west of the Estancia basin and the Pedernal positive, and on the northeast by the Penasco positive.

Fine clastic sediments from the Zuni and medium to coarse sediments from the Penasco make up less than one-fourth of the Pennsylvanian section which is predominantly limestone. The sharp down-warp of the Estancia basin to the east, as a southerly basin of the central Colorado-Sangre de Cristo seaway, resulted in entrapment of westerly moving coarse clastics from the Pedernal uplift.

The Sandia - Manzanita - Manzano-Joyita tectonic alignment (of Tertiary age) was a long narrow platform or "sill" which separated the thick clastic-filled Pennsylvanian section of the Estancia basin from the somewhat thinner but normal basinal and shelf carbonate section of the Lucero basin.

Bioherms grew on the gently shelving east sides of the Central New Mexico accessway as indicated by outcrops of calcarenite mounds containing **Chaetetes** sp. corals in the Sandia and Manzano Mountains. Inasmuch as the Pennsylvanian outcrops at Monte de Belen and Gray Mesa along the Lucero uplift show basinal lithology in Des Moinesian and early Missourian strata and the entire section thins to zero westward onto the Zuni positive, it is likely that similar reefoid masses will be found in the subsurface in the area surrounding the corner common to Catron-Socorro-Valencia counties.

Owing to Laramie folding and Tertiary faulting, the eastern two-thirds of the Pennsylvanian Lucero basin is buried deeply beneath the valley fill of the Rio Grande trench, and parts of the platform between the Estancia basin on the east and the Lucero basin on the west now stand high as the Sandia-Manzano block-fault mountains.

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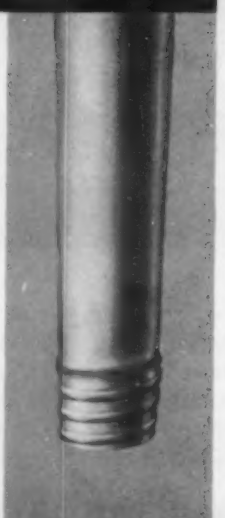

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Paleozoic Stratigraphy of the Black Mesa Basin, Northeastern Arizona and Surrounding Areas

Wolfgang E. Elston
University of New Mexico, Albuquerque

Paleozoic sedimentary rocks in the subsurface of the Black Mesa basin of northeastern Arizona include 0-800 ft. of Cambrian dolomite sandstone, shale, and minor limestone; 0-300 ft. of Devonian dolomite and sandstone; 0-500 ft. of Mississippian dolomite and limestone; 0-500 ft. of Pennsylvanian redbeds and limestone; and about 2,000 ft. of Permian redbeds and eolian sandstone capped by 0-400 ft. of dolomite near the western edge of the basin. These rocks do not crop out, and only a few wells have penetrated them to date.

Isopach and lithofacies maps show that in all Paleozoic systems the thick marine carbonate sections of northwestern Arizona and southwestern Utah pinchout, became more clastic, or interfinger with continental sedimentary rocks to the southeast in the direction of the Black Mesa. At no time during the Paleozoic or Mesozoic eras was the Black Mesa area a basin in the sense that it was the site of deposition of marine sediments significantly thicker than in surrounding areas.

The Black Mesa structural basin was formed by differential uplift in Cenozoic time. When the Colorado plateau was uplifted the Black Mesa rose 3,500 to 7,000 ft. less than surrounding areas.

Possibilities for oil and gas discoveries in stratigraphic traps seem best in the northern and western parts of the Black Mesa basin, where several permeable formations appear to pinch out.

Geologic Controls in Oil and Gas Exploration in Southwestern New Mexico and Southeastern Arizona

Robert A. Zeller, Jr.
State College, Pa.

In southwestern New Mexico and southeastern Arizona the Paleozoic and Cretaceous sedimentary sections average between 15,000 and 20,000 ft. in maximum thickness and consist largely of carbonate rocks. Humble Oil & Refining Co.'s recent well in southwestern New Mexico demonstrates the presence of oil stain and natural gas in the section. With such a thick sedimentary section and the known presence of oil and gas the regional potentialities of commercial oil and gas are good.

Successful exploration in the region depends largely upon the discovery of sufficient porosity and favorable structural traps. Many stratigraphic units are consistent throughout the region and have low porosity, but others have regional differences, such as the presence of reefs, which favor higher porosity. Lower Cretaceous reefs in the region are distributed erratically, and neither reef trends nor the presence of reefs in the subsurface may be determined without intensive study.

Lower Wolfcampian reefs, on the other hand, are more restricted stratigraphically and their trends may be determined. Since all other stratigraphic factors regarding favorable porosity are constant or at present are undetermined in the region, present exploration may best be concentrated in the belt where lower Wolfcampian reefs may be expected.

The location of structural traps requires a fundamental understanding of the structural geology of the region. Two chief structural disturbances affected the region, an early one which in general correlates with the Laramide orogeny and a later one which correlates with the Basin and Range disturbance. Laramide structures include high-angle faults, large strong folds, and overthrust faults. Basin and Range structures include high-angle faults, broad gentle folds, and normal or "block" faults which produced the elevation of the ranges and the depression of the valleys.

Basin and Range folds are so mild compared to earlier strong Laramide folds that their effect on pre-Tertiary rocks is negligible. Laramide anticlines, possibly in combination with later faults, supply the most favorable structural traps. Thick deposits of Tertiary volcanic rocks and of alluvium cover much of the area so the discovery of favorable structures must be based upon projection of exposed folds under covered areas and upon geophysical techniques.

California's Brite gets confirmation

THE FIRST confirmation well to last December's Brite pool discovery in Kern County's Mountain View field was brought in by Union Oil Co. of California. The new well, 66-16 Union-Signal-Jewett, is a northwest offset to the discovery. It was completed flowing from the Lower Miocene Jewett sand selectively perforated between 7,975 ft. and 8,312 ft. Initial production was 199 bbl. daily gross, 189 bbl. net of 33.7°-gravity crude through a 20/64-in. choke.

The Brite pool discovery well, also drilled by Union, tapped the Jewett at 8,114-8,314 ft. for initial flow of 437 bbl. daily, 6% cut. Both wells are in SE SE 16-31s-29e. The Brite pool locations are on the west edge of the Di Giorgio area of the Mountain View field near Arvin.

Kentucky well completed

In the Pike County sector of Big Sandy gas field and located on Abner Fork, United Carbon Co. has completed 2696 Republic Steel Corp. as a Mississippian Big Lime gas producer. Bottomed at 2,947 ft., the well flowed initially at the rate of 2,970 M.c.f.d. of gas.

Michigan makes record number of new starts

Carter Oil Co. took drilling permits for 11 locations in the Pulaski and Albion areas of southern Michigan and Salem (Salina gas) field, Allegan County, to pace a record week for new starts.

Twenty-four locations were reported for all companies during the week.

A. E. Rovsek and McClure Drilling Co. spudded 1 Olynik, NW NW NE 15-3s-4w, Calhoun County, 1½ miles northwest of the Albion Trenton discovery and first major stepout for the play.

Carter Oil Co. 1 Farley, NW SW NW 23-3s-4w, 1,320 ft. north of the Albion discovery, has cored from 3,905 to 4,276 ft. with probable oil pays in a 100-ft. section of Trenton dolomite from 4,136 to 4,250 ft.

Carter, Sun Oil Co. and Union Development Co. each had offset wells drilling the Trenton section in the Pulaski area, Jackson County, first tests of the play since discovery in January this year.

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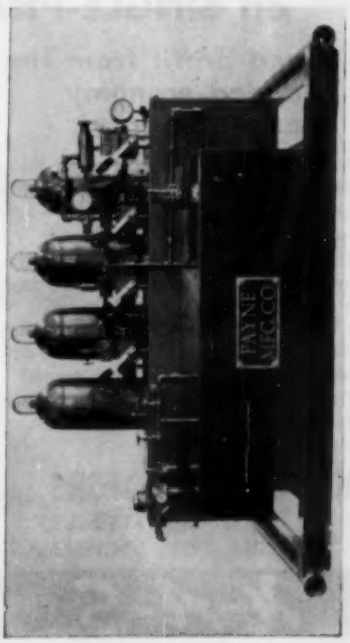

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Humble to try again in East Los Angeles

Humble Oil & Refining Co. has suspended operations at 5,045 ft. on its wildcat drilled in the San Gabriel area east of metropolitan Los Angeles.

The rig was being skidded for another try. Nearest production is 2½ miles north of Montebello oil field.

Myron T. King has suspended operations on his Mojave Desert wildcat near Barstow at 3,553 ft.

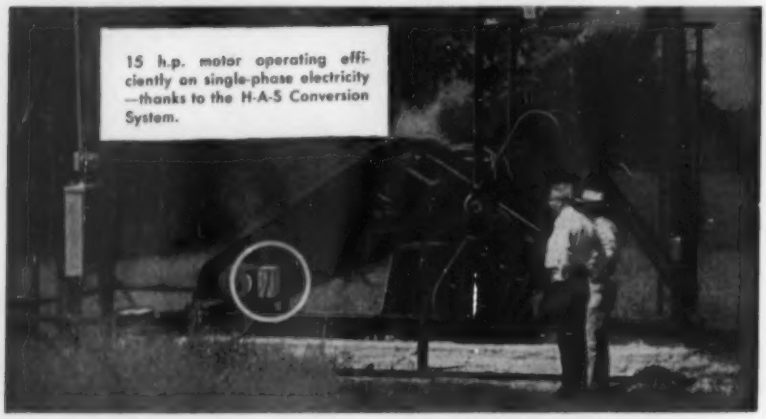
Ohio Oil Co. abandoned at 10,533 ft. a wildcat 7 miles west of Richfield Oil Corp.'s San Emidio field in Kern County.

The Texas Co. plans a 12,500-ft. wildcat 1¾ miles southwest of San Emidio field.

Offset completed to California's Pleito Ranch

A southwest offset to Shell Oil Co.'s new pool discoverey in the Pleito Ranch field of Kern County was completed pumping 207 bbl. daily from 9,182-9,491 ft. This well was originally taken to 12,153 ft., plugged back to 6,420 ft. and redrilled to 10,854 ft. for the completion.

This well, 35-36 KCL, is a southwest offset to the discovery well completed by Shell in SW SW 25-11n-21w last June. The producing formation is in the Upper Miocene Chanac.



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McColl 2-7-69-8 Swan Hills, LSD 2, 7-69-8w5. Slave Point oil discovery. TD 7,319 ft.

Hudson's Bay-Union 10-14-77-25 Eaglesham, LSD 10, 14-77-25w5. D3 oil discovery. TD 8,294 ft.

Pan American-B.A. 10-21-66-10 Swan Hills, LSD 10, 21-66-10w5. Slave Point oil discovery. TD 8,660 ft.

Cal Standard-CPR 11-22-18-13 McBeth, LSD 11, 22-18-13w4. Sunburst oil discovery. TD 7,496 ft.

Colorado et al. 6-14-25-9 Bigoray, LSD 6, 14-52-9w5. Pekisko gas discovery. TD 6,530 ft.

British-American 6-10-41-19 Red Willow, LSD 6, 10-41-19w4. Glauconitic gas discovery. TD 6,600 ft.

Shell 6-28-30 Waterton Park, LSD 6, 28-3-30w4. Mississippian gas well. TD 15,205 ft.

British Columbia: Gulf States 3 Kotcho Lake, 67-K-94-I-14. Slave Point gas discovery. TD 6,459 ft.

Sinclair B-8 2 Pacific, 39-E-94-A-16. Gething gas discovery. TD 3,717 ft.

CALIFORNIA

Kern County: Golden Bear Oil Co. 26X-10 Garrison City KCL, NW SW 10-28s-24e, 1,865 M.c.f.d., ¼-in. choke, perfs. 3,452-58 ft., TD 6,000 ft. (Shallower gas sand discovery in recently discovered Garrison City gas field).

NORTH LOUISIANA

Caddo Parish: Coulston Drilling Co. and Sunray Mid-Continent Oil Co. 1 Clements, 19-23n-14w, 2⅞ miles southeast of Ida. IPP 50 BOPD (pumping and flowing), 38.3°, CP 150 psi., perf. 3,058-68 ft., Tokio. TD 6,808 ft. Elev. 209 ft., Tokio 2,800 ft., Sligo 6,368 ft. New field.

SOUTH LOUISIANA

Lafayette Parish: J. P. Owen et al. 1 Mrs. A. C. Trahan, 7-9s-4e. IP 96 BOPD, 1,913 M.c.f.d., ⅛-in., 52°, TP 3,200 psi., perf. 11,836-40 ft. TD 12,523 ft. Second well and new pay in North Ossun field.

J. P. Owen et al. 1 Lenese Domingeau, 7-9s-4e. IP 88 BOPD, 1,240 M.c.f.d., ⅛-in., 50.5°, TP 5,495 psi., perf. 11,748-51 ft. TD 12,656 ft. New pay in North Ossun field.

Richardson & Bass (Louisiana Account) 1 Carmelite A. Stutes, 12-10s-3e, 2½ miles southeast of Scott field. IP 46 BOPD, 2,239 M.c.f.d., 7/64-in., 47°, TP 9,000 psi., perf. 12,756-62 ft. TD 15,500 ft. New field.

MISSISSIPPI

Pearl River County: Fred LaRue and Robert A. Lee 1 U. S. A. Unit, 13-1s-14w. IP 1,980 M.c.f.d., 16 BC per M.M.c.f., 10/64-in., TP 2,840 psi., perf. 8,046-53 ft., lower Tuscaloosa-Stevens sand. TD 9,210 ft. Elev. 217 ft., lower Tuscaloosa 7,919 ft., Stevens sand 8,045 ft.,

Lower Cretaceous 8,475 ft. Extends Pistol Ridge field.

Scott County: Shell Oil Co. 1 Rogers Estate et al., SW NE 9-5n-6e, 1½ miles northwest of Independence. IP 156 BOPD, 16/64-in., 32.9°, TP 60 psi., GOR 487 cu. ft. per barrel, perf. 6,410-20 ft., Eutaw. TD 11,062 ft. Elev. 528 ft., Eutaw 6,040 ft., Tuscaloosa 6,545 ft., Lower Cretaceous 7,706 ft., Cotton Valley 10,790 ft. New field—Independence.

OKLAHOMA

Beaver County: Harper 1 Miller, NW NW SE 1-3n-23eCM. IP 7,684 M.c.f.d., open flow, Morrow 7,117-45 ft. TD 7,400 ft. Gas discovery.

Cimarron County: J. S. Abercrombie 1 Twining, C SE SE 28-5n-7eCM. IP 13 M.M.c.f.d., open flow, Atoka 4,128-36 ft., Keyes 4,824-34 ft. TD 5,023 ft. Dual completion. Gas discovery.

Ellis County: Magnolia Petroleum Co. 1 Meier C SE NW 36-20n-26w. IP 12,800 M.c.f.d. Morrow 10,668-11,245 ft. TD 11,466 ft. Gas discovery.

NORTH TEXAS

Cooke County: Sinclair Oil & Gas Co. 49 D. A. Cox, Blk. 59, Gannin CSL Sur., 12 miles northeast of Gainesville, Canyon sand discovery in Walnut Bend field. IPP 153 BOPD, 38.6°, Canyon 2,168-71 ft.; IPP 14 BOPD, 35°, Walnut Bend 1,530-34 ft. TD 2,243 ft.

Wise County: Lone Star Producing Co. 1-VT R. E. Meeks, W. A. Snow Sur., A-1209, 10 miles northwest Bridgeport. New pay discovery in Boonsville Bend Conglomerate gas area. IPP 45 BOPD, 42.5°, GOR 4968:1, pay 5,246-57 ft. TD 5,835 ft., PB 5,711 ft. Elevation 872 ft.

SOUTHWEST TEXAS

Brooks County: Carrl Oil Co. et al. 1-A Jack Casey, John M. White Sur. 630, A-40, 15 miles southwest of Falfurrias. IP 73.31 BOPD, trace water, 9/64-in., 47°, TP 455 psi., perf. 5,279-85 ft. TD 6,320 ft. New pay in Bob Cooper field.

Duval County: The Texas Co. 7-B D. C. R. C. NCT-32, Sec. 203, Norman G. Collins Sur., A-918, 6 miles north of Freer. AOR 20,700 M.c.f.d., dry gas, shut-in TP 413 psi., open hole 918-35 ft., Frio. TD 2,131 ft. New pay in Petrox field.

Zavala County: San Miguel Lease & Royalty Co. 1 Mathews, Sec. 7, Thomas C. Rife Sur., A-769, 4½ miles southwest of La Pryor. Potential gas well, untested, sand 1,940-51 ft., Navarro-Olmos, 4½-in. casing 2,118 ft., not perforated. TD 3,300 ft. New field—1½ miles northwest of Little Tom field.

TEXAS GULF COAST

Harris County: Carter Taylor 1 Oates Unit, John Trobough Sur., A-59, 2 miles east of Houston. IP 120.75 BOPD, ⅛-in., 37°, TP 300 psi., GOR 0 perf. 3,819-23 ft., Miocene. TD 6,532 ft. New pay in Clinton field.

Nueces County: Gillring Oil Co. 1 Winfield, Sec. 85, George H. Paul Subd., 2 miles west of Banquete. AOF 24 M.M.c.f.d., GLR 73.6 M.c.f. per barrel, 64.4°, shut-in TP 2,060 psi., perf. 5,466-74 ft. TD 6,070 ft. New pay in Agua Dulce field.

Arkansas Fuel Oil Corp. 2 State Tract 14, Corpus Christi Bay, 3 miles east of Portland. AOF 11,750 M.c.f.d., GLR 88.4 M.c.f. per barrel, 56.4, shut-in TP 2,957 psi., perf. 8,838-48 ft. Frio. TD 9,220 ft. New pay in Northwest Corpus Christi Bay field.

WEST CENTRAL TEXAS

Jones County: W. W. F. Oil Corp., et al. 1 Joe Teague, Sec. 20, Blk. 2, SPRR Sur., 3 miles southwest Anson. IP 56 BOPD, 16/64-in. choke, 40°, GOR 730:1, TP 70 psi., Palo Pinto limestone 4,143-48 ft. TD 4,149 ft. Ground elevation 1,737 ft.

Shackelford County: J. E. Miller Drilling Co. 2-15-A Ackers, Sec. 15, Blk. 13, T&P Sur., 15 miles west of Albany. IP 57 BOPD, 14/64-in. choke, 38°, GOR 1,140:1, Cook sand 1,611-16 ft. TD 1,627 ft.

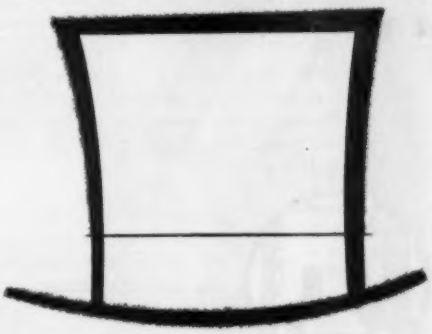
Throckmorton County: Carter-Gifford Oil Co. 1 Helen C. Poage, Sec. 692, TE&L Sur., A-293, 4½ miles west of Woodson. IP 300 BOPD, 20/64-in. choke, 40°, GOR 419:1, TP 165 psi., Mississippian 4,543-57 ft. TD 4,650 ft. Ground elevation 1,262 ft.

WEST TEXAS

Crockett County: Fred Turner, Jr., 3 Shannon "BB," Tract 22, Lge. 4, Archer CSL Sur., 5 miles southeast of Iraan, new pay in Southeast Noelke-Queen field. IP 2,152 BOPD, 1¾-in. tubing, 31.5° GOR 400:1, TP 150-200 psi. Queen 1,849-51 ft. TD 1,851 ft.

McCulloch County: New Seven Falls Co. 1 L. S. Walker, E. R. Crockett Sur. 1193, 5½ miles east of Doole, 10 miles northwest of Big Chief field. IP 1,050 M.c.f. gas, with trace of condensate, Strawn sand 1,359-68 ft. TD 2,320 ft., ground elevation 1,451 ft.

Runnels County: Anderson & Graham 1 T. V. Jennings, R. Clever Sur. 521, 3 miles south of Winters. New pay in Winters-Gardner field. IP 106 BOPD, 16/64-in. choke, 45°, GOR 350, TP 150 psi., Caddo 4,468-72 ft. TD 4,541 ft.



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LARKIN FILRITE CEMENTING EQUIPMENT

For automatically filling the casing from the bottom while casing is being run.

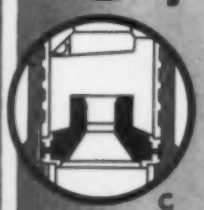
The prime functions of Larkin Filrite Cementing Equipment are:

1. To eliminate the "piston-effect" of pressure surges which occur when closed-end casing is being lowered. This reduces the hazard of breaking down weaker formations.

2. To speed up the casing run by eliminating time-consuming surface fill-up of the casing. Uninterrupted lowering of the casing reduces the possibility of casing becoming stuck before reaching bottom.

Circle A, a view 90° from that of the large illustration, shows the Filrite valve in running-in position. The resilient diaphragm valve remains closed until the differential fluid pressure across it overcomes its inherent resistance to open.

Circle B shows the rubber diaphragm inverted by pump pressure as the well is being cemented. Filrite is full opening and will allow passage of a bridging to actuate other equipment which might be installed on the casing beneath a Filrite Collar.



Circle C shows the spring-loaded flapper valve in closed position after being released by inversion of the diaphragm. The flapper valve in the Larkin Filrite equipment is very strong and has no depth limitations.

Available but not illustrated:

Filrite Collar, Filrite Geyser Shoe and Filrite Geyser Collar

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LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

Totten Expands Operations

. . . by stepping up to post of exploration vice president for Western Operations, Inc. He sees new job as challenge.

"IF I weren't excited about this new job, I'd never have moved so far from the hunting and fishing paradise of Colorado."

It took the job of director and vice president of exploration for Standard Oil Co. of California, Western Operations, Inc., to lure S. W. (Stan) Totten from his Rocky Mountain sportsman's haunts. Totten took over his new post last month from O. F. Van Beveren, who joined American Overseas, Ltd., in New York.

Totten was serving as exploration vice president for the western region of the The California Co., a Standard subsidiary, in Denver.

"Like everybody else, I loved it in Colorado, especially when my wife Priscilla and I could get away to our cabin by the Red Feather Lakes near Rocky Mountain Park," Totten said. "But when they offered me the chance to direct exploration activities in such places as offshore California and Alaska for a company like Western Operations, there was no argument."

The Tottens have moved to Belvedere, north of San Francisco, and he is in the midst of a get-acquainted tour of his areas of operations in the west.

Background . . . Totten, born in Orange, N. J., in 1916, attended Rutgers and Columbia universities.

In 1942, Totten joined the Tennessee Valley Authority, supervising core drilling. Less than a year later, he accepted a job as a geophysicist with the Coast and Geodetic Survey based at Sitka, Alaska. He served there throughout World War II.

He can draw on this experience since one of the main areas of operations in his new post will be Alaska, where Standard of California is drilling on the Kenai peninsula.

Totten is also experienced in the offshore techniques which are coming into their own in California. When he was hired by The California Co. in 1945, his first job was as observer on a seismic crew. In the following years, both his off and onshore experience grew with service as geologist in Mississippi and Alabama, district superintendent for the Mississippi-Florida district and exploration superintendent for the southeastern division.

In 1955 he moved to Denver as boss of western region exploration. In these jobs, Totten helped bring Calco to its present position of eminence in Gulf producing areas.

New job . . . Totten, a stocky businesslike man with slightly greying dark hair, has tackled his new work with an enthusiasm which indicates he'll be a tough customer in the rugged race for production in Alaska and other remote western regions.

"The magnitude and degree of integration of the Standard of California exploration program in the west is impressive to say the least," Totten said. "It's going to take some doing to match the records of my predecessors, and I might add I'm a little scared."

However, spend an hour with him while he talks of the oil future of the west and his plans for Standard's share in that future, and Totten doesn't seem like a man who's running scared. On the contrary, he leaves the impression that he believes the years to come will see the discovery of vast new reserves in the west—and he plans to have a part in it.

Howard W. Davenport, vice president and a director of Woodley Petroleum Co., has been elected a director of Pan American Sulphur Co.

Ben F. Faulkner, formerly manager of Barbados Gulf Oil Co., has been assigned to Bolivian Gulf Oil Co. as drilling superintendent.

Edward W. Upton, vice president in charge of engineering for Refinery Engineering Co., has been named executive vice president. He succeeds **D. O. Givens,** who has resigned. Upton joined Treco in 1957. He had been vice president and general manager of F. H. Maloney Co., Houston, before that time.

Dr. Warren G. Meinschein, formerly with Magnolia Petroleum Co., has joined the research staff of Esso Research & Engineering Co.

David C. Bintliff, Houston, has retired as director and vice chairman of Associated Oil & Gas Co. and sold his interest in the company to **Walter N. Maguire** and his son, **Walter L. Maguire.** Bintliff was an original founding stockholder of Associated.

Harry J. Gaston, Jr., formerly petroleum engineer with Continental Oil Co., has joined Robert W. Harrison & Co., Houston consulting firm.

Duane Davis has been appointed assistant manager of Creole Petroleum Corp.'s La Salina district in Venezuela.

Henry Schaefer, equipment engineering supervisor for Pan American Petroleum Corp. in Tulsa, has been transferred to the New York offices of Pan American International Oil Co. as senior staff engineer.

New York Nomads Name New President

Don E. Kircher, right, export sales manager for Gardner-Denver Co., has been elected president of the New York chapter of National Oil Equipment Manufacturers and Delegates Society (Nomads). He is shown accepting the gavel from E. E. Andreason, Andreason-Lundberg Corp., outgoing president.

Robert T. Goodwin has resigned as chief geologist with Stekoll Oil & Gas Co. in Estevan, Sask., to join Johnson Oil Co., Minot, N. D., as coordinator of geology and exploration.

Walter Shirley, engineer for Richfield Oil Corp. in New Cuyama, Calif., has been transferred to Los Angeles as mathematician in programing of petroleum engineering problems.

R. P. Medlin, chief process engineer in charge of technical department planning and coordinating section for Magnolia Petroleum Co. in Beaumont, Tex., has been named an engineering supervisor in the economics department. He will work with economic problems in refinery planning and operations.

L. L. McDonald, Pure Oil Co., Fort Worth, has been elected chairman of American Petroleum Institute's southwestern district, Division of Production. **Ellsworth Showen,** Gulf Oil Corp,. Midland, Tex., has been named chairman of the district advisory committee, and Clancy Olson, Dowell Division of Dow Chemical Co., Dallas, is secretary-treasurer. Vice chairmen of the district are: **Pat Fletcher,** Atlantic Refining Co., vice chairman for West Texas; **Guy Baber,** National Supply Co., Southeast New Mexico; **W. C. Werner,** Humble Oil & Refining Co., North Central Texas; **Ewell Walsh,** El Paso Natural Gas Products Co., Northwest New Mexico; **Luther Reynolds,** Pan American Petroleum Corp., South Plains vice chairman; **John P. Holle,** Sinclair Oil & Gas Co., Northeast Texas.

William E. Stiles, Stiles Engineering Co., has been nominated for chairman of Mid-Continent section of AIME'S Society of Petroleum Engineers. He will succeed **John Eckel,** Jersey Production Research Co. Two candidates have been nominated for other offices. Election will be by mail ballot. Other candidates are, for first vice chairman, **Virgil J. Berry, Jr.,** Pan American Petroleum Corp., and **Ray S. Ousterhout,** Dowell Division of Dow Chemical Co.; for second vice chairman, **H. A. Nedom,** Amerada Petroleum Corp., and **David A. Wilson,** Earlougher Engineering Co.; for secretary, **Ernest E. Finklea,** Schlumberger Well Surveying Corp., and **C. L. Wilson,** Sinclair Oil & Gas Co.; for treasurer, **F. M. Stewart,** Alex McCoy & Associates, Inc., and **J. W. W. Whitney, Jr.,** Helmerich & Payne, Inc. Three executive committee members will be elected from the following candidates: **Bernard L. Bocella,** Baroid division of National Lead Co.; **Herman H. Kaveler,** Tulsa consultant; **Charles H. Keplinger,** Keplinger & Wanenmacher; **Frank Purdum,** Wright Petroleum Labs, Inc.; **Cole Sylvester,** Ohio Oil Co.; **Alton B. Cook,** U. S. Bureau of Mines; and **Martin Felsenthal,** Continental Oil Co.

Charles T. Hollenshead has been named manager of El Paso Natural Gas Co.'s exploration research laboratory in Salt Lake City.

John Burns, process engineer with Continental Oil Co., has been transferred to the company's Gretna, La., petrochemical plant, from Ponca City, Okla.

L. C. Bonham has been named supervising research geologist in exploration research at California Research Corp.'s La Habra, Calif., laboratory.

Dr. Abraham Schneider, manager of basic research in Sun Oil's research and development division, has been appointed research scientist. **Dr. Raymond Wynkoop,** who joined the company last year as assistant director of petrochemicals, will succeed Schneider.

R. C. Curtis, vice president and a director of Jersey Production Research Co., has been elected executive vice president. **H. W. Haight,** chairman of Carter Oil Co., has been elected a director of Jersey Production. He will also be a member of the executive committee. Haight succeeds **C. G. Herrington,** Carter vice president, as that company's representative on the Jersey Production board. Curtis has been with Standard Oil Co. (N. J.) and its affiliates since 1937. He was eastern division manager for Carter before becoming vice president and a director of Jersey Production last year. Haight, former president of Creole Petroleum Corp., was elected chairman of Carter last month.

CURTIS

Raymond Gibson, senior process engineer for Vickers Petroleum Co., has been named manager of the refinery blending and transfer section. **Francis Grabner** continues as blending and transfer superintendent.

Albert F. Lager, resident manager of Oasis Oil Co. of Libya, has been named special representative in foreign operations for Ohio Oil Co., the parent company. **R. E. McMillen,** manager of Ohio's Sidney, Neb., production district, will succeed Lager. **Fredrick C. Aldrich,** supervisor of engineering and contracts in the natural gas division, will move to Sidney from Findlay, Ohio, to succeed McMillen.

Evans Elected President of Montana AIME Petroleum Section

Charles B. Evans, second from right, Schlumberger Well Surveying Corp., has been elected chairman of the Billings, Mont., section of AIME's Society of Petroleum Engineers. Officers are, left to right, Wayne Fincher, McAlester Fuel Co., director; Fred A. Haddenhorst, Mobil Oil Co., secretary-treasurer; Fraser M. Burbank, Mobil Oil Co., director; Gordon Lansford, Halliburton Oil Well Cementing Co., second vice chairman; Evans, and L. M. Lyon, Carter Oil Co., first vice chairman. Not pictured is N. J. Matthews, Shell Oil Co., a director.

Oval E. Gilbert, measurement engineer with Michigan Wisconsin Pipe Line Co., has been transferred to Guymon, Okla., from Fond du Lac, Wis.

Robert M. Taubman has been named a vice president of Buffalo Petroleum Corp. He will supervise the West Texas and New Mexico division from the company's Midland, Tex., offices.

Malcolm E. Grant, executive vice president of Plantation Pipe Line Co., has been elected president and chief executive officer. He succeeds **Charles R. Younts,** president since organization of Plantation in 1941, who becomes chairman of the board.

Jack Menneer, former chief engineer for Anglo-American Exploration Co., has joined Stekoll Petroleum Co. as manager of the exploration department in Calgary. He succeeds **John Bonds,** Stekoll partner, who has moved to Los Angeles as investment manager. **Peter Watkins** will be assistant to Menneer in Calgary.

Walter S. Hallanan, president of Plymouth Oil Co. and chairman of the National Petroleum Council, will serve as chairman of a special NPC committee on national emergency oil and gas mobilization. **Morgan J. Davis,** president of Humble Oil & Refining Co., will head the committee on use of radio and radar. **R. L. Milligan,** president of Pure Oil Co., was named chairman of the committee on petroleum storage facilities. The three committees will make studies requested by the Government. **Frederick S. Lott,** assistant director of the Office of Oil and Gas, will serve as government co-chairman for the mobilization study group. **Hans C. Jensen,** Office of Oil and Gas, will be government co-chairman for the other two committees.

Jerry R. Kyle, Carter Oil Co.'s Oklahoma City division exploration manager, has been transferred to Tulsa as coordinator of foreign geophysics. **T. P. Woodward,** Mattoon, Ill., division exploration manager, will succeed Kyle. **E. S. Conway,** Oklahoma City division geologist, moves to Mattoon to replace Woodward. **W. W. Solter** becomes division geologist in Oklahoma City. Carter has transferred **S. W. Stone,** division geologist in Shreveport, La., to Billings, Mont., in the same capacity. He succeeds **L. T. Hart,** who will do special stratigraphic studies in the Billings office. **Robert Beall** will replace Stone in Shreveport. **J. C. McCulloch,** Denver division geologist, has been named assistant to the chief geologist in Tulsa. **J. D. Langston** moves to Denver from Rawlins, Wyo., to replace McCulloch. Also, **Max E. Ferrell,** Tulsa, has been named district exploration manager in Grand Rapids, Mich. **J. B. Coffman,** Wichita, has been named district geologist in Rawlins. **Leroy Foll** becomes Wichita area geologist. **C. E. Doran,** Tulsa, has moved to Shreveport, as area geologist for southern Arkansas.

Harold W. Nelson, manager of research in Great Lakes Carbon Corp.'s research and development department, has been promoted to technical director of the carbon division. He will continue to headquarter at the company's Morton Grove, Ill., research center.

W. A. M. Greeven, formerly deputy marketing coordinator for Standard Oil Co. (N. J.), has taken over as shareholders' representative of Jersey Standard for its affiliates in Italy, Austria, and Switzerland. He succeeds **Ralph P. Bolton,** who has held this post since 1957.

Paul W. Rogers, vice president and chief engineer of Ohio Fuel Gas Co., has been elected a director. **Herbert A. Titsch,** manager of the production department, has been elected a vice president. Rogers has been chief engineer since 1953. He became a vice president in 1956. Titsch was elected an assistant vice president and executive assistant in the production department last year. He became manager of production in January after retirement of **W. E. Ferguson.**

ROGERS

TITSCH

Personals

Paul K. Kuhne, formerly director of refinery technology in Gulf Oil Corp.'s manufacturing department, has been appointed associate director of research for Gulf Research & Development Co. He will headquarter in Harmarville, Pa. Kuhne has been with Gulf since 1927. He served as supervisor of the refinery technology division and assistant to the general manager of the manufacturing department before being named director of refinery technology in 1955.

B. J. Rea, Texas division manager for Jocelyn-Varn Oil Co., has been named manager of the new property-purchase department. The new department will handle purchase of producing properties and will operate properties which Jocelyn-Varn manages for other firms. **William Saxon,** formerly manager of the land department, will succeed Rea as Texas division manager.

Walter S. Hart, geophysicist for Tidewater Oil Co., has been promoted to district geophysicist in Oklahoma City. **John W. Stephenson,** Tidewater area engineer in Robinson, Ill., has been promoted to Robinson district engineer. **Eben D. Junkin,** area engineer in Crane, Tex., has been transferred to Robinson in the same capacity.

Ener H. Nelson, formerly chief process engineer in charge of process engineering laboratories at Magnolia Petroleum Co.'s Beaumont, Tex., refinery, has been transferred to Dallas. He will supervise company projects and programs in the new economics department there. **W. P. Wallace,** assistant chief chemist in product control laboratories, will succeed Nelson in Beaumont. Also at the Beaumont refinery, **W. E. McKellar, Jr.,** assistant manager of employe relations, has been moved to the economics department. **R. B. Kennedy,** assistant to the general superintendent and formerly process supervisor, will succeed McKellar in employe relations.

Robert H. Vick, chief engineer for secondary recovery for Ambassador Oil Corp., has been promoted to manager of engineering. Three departments have been combined to form the company's new engineering department. **J. D. Christner** has been named assistant to Vick and will continue as chief primary engineer. **Russell Meyers** will be senior petroleum engineer. Vick was manager of engineering for Graridge Corp. before joining Ambassador. He is a graduate of the University of Oklahoma.

VICK

E. F. McGee, sales manager of Shell Oil Co.'s Detroit division, has been promoted to manager of the Sacramento, Calif., marketing division. **J. S. Hoppock,** St. Louis division operations manager, becomes manager of the Minneapolis division. **F. H. Staub,** sales assistant to the vice president of Shell's midwestern marketing division, has been named Chicago marketing division manager.

Deaths

John K. Wright, Jr., 42, Jackson, Miss., consultant and independent operator, died March 4 in an automobile collision near Monroe, La. Wright, Mississippi vice president of Independent Petroleum Association of America, was returning to Jackson after attending an IPAA meeting in Shreveport, La. Wright was chief engineer for McAlester Fuel Co. and petroleum engineer with the Mississippi Oil and Gas Board before becoming an independent. He was a graduate of the University of Oklahoma.

John Burke (Jack) Barnes, 59, Tulsa independent operator, died March 9 at his home in Tulsa after a heart attack. He had been in ill health for several years.

Carl Franklin Lewis, 30, driller with South Oil Co., died March 4 in a Tulsa hospital from injuries suffered in a light-plane crash near Sequoyah, Okla.

Ernest Brown, 66, retired construction superintendent for Wilcox Oil Co., died March 2 at his home in Stroud, Okla., after a heart attack. Brown retired last year after 28 years with Wilcox.

William Eugene Freelin, 44, of Norwalk, Calif., chief inspector for Fluor Corp., Ltd., died March 7 in a Houston hotel.

Maynard E. Hankins, 45, Houston division purchasing agent for The Texas Co., died March 8 in a Houston hospital after an illness of several months. A graduate of the University of Minnesota, Hankins joined Texaco in 1936.

H. Leslie Parker, 68, pioneer Rocky Mountain area independent, died March 5 in Denver after a heart attack. Parker is credited with many firsts in Rocky Mountain drilling. He drilled his first well in 1911 near Log Cabin, Wyo., using the first all-steel cable-tool rig in the state. He later was credited with bringing the first rotary rig into Wyoming. He was discoverer of the state's Bid Muddy field and the nearby town of Parkerton was named for him in 1916. He was active in Teapot Dome, Midway Dome, and Salt Creek fields. He was one of the organizers of Colorado Associated Oil Co. He was a founder of the Denver Petroleum Club and served as president in 1954. He was president of the Pioneer Oil Men of the Rockies group in 1953.

Joseph M. Green, 65, retired D-X Sunray Oil Co. attorney, died March 7 at his home in Tulsa. Green retired in July 1958 after 36 years with D-X and predecessor companies. He joined Petro-Atlas Corp. as head of the lease records division but was hospitalized with a brain tumor soon after taking the position.

John Blair Moffett, 73, counsel for Sun Oil Co. and senior partner in the Philadelphia law firm of Moffett, Frye & Leopold, died March 8 in Bryn Mawr, Pa. Moffett joined Sun in 1922. He was a director of SunGas, Inc., assistant secretary of Sun Pipe Line Co. and a former director of Sun Oil Co., Ltd., a Canadian subsidiary.

Marion (Bob) Wrensch, 49, district production foreman for Sinclair Oil & Gas Co. in Carmi, Ill., died recently in Evansville, Ind., after a heart attack.

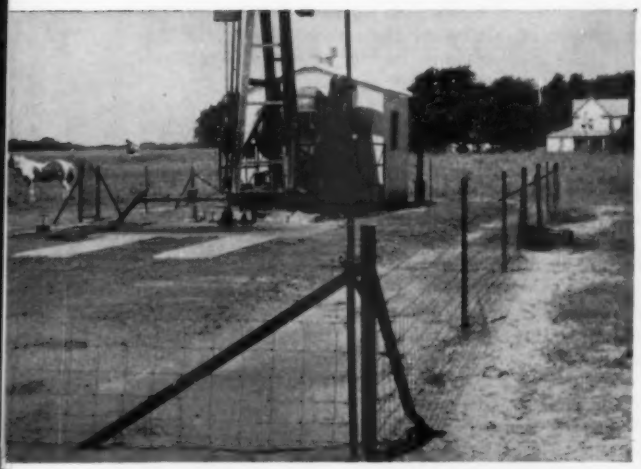
Thomas Foster Devlin, 61, Union Oil Co. engineer, died recently in a Bakersfield, Calif., hospital.

Lysle P. Burgess, 76, retired oil-well supply manufacturer, died recently in Los Angeles.

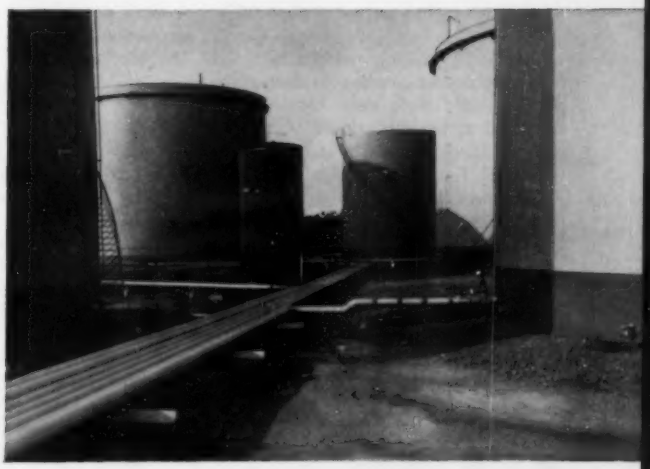
• Note the complete control of fire-hazardous vegetation with "Telvar" around these pipelines of the Tidewater Oil Co., which pass largely through a marshy area. Without "Telvar", weed control would have required costly hand labor.

• In this refinery of the Cities Service Oil Co., "Telvar" applied in May kept area weed-free entire season. In the oil industry, fire hazards and maintenance problems are greatly reduced by weed control with "Telvar" and "Karmex".

Avoid fire hazards...reduce maintenance costs spray just once with a Du Pont Weed Killer for season-long control



• "Telvar" was applied around this producing well of the Phillips Petroleum Co. in April, and this photo was taken five months later. "Telvar" and "Karmex" are non-volatile, non-corrosive, non-flammable . . . can be applied in producing fields without damage to property or hazard to livestock.



• Note the thorough job of controlling vegetation with "Telvar" around these tanks and pipes. Weeds and grasses can feed fires, make maintenance difficult, and the moisture they hold can cause corrosion. "Telvar" and "Karmex" control unwanted vegetation easily and economically.

Now you can eliminate weeds and grasses that create fire hazards and make maintenance difficult. Just one application of Du Pont "Telvar" monuron or "Karmex" diuron weed killer controls weeds for a season or longer.

"Telvar" and "Karmex" kill weeds through the roots . . . remain in the soil to provide residual action. Easy to handle, economical to use. Be sure to specify "Telvar" or "Karmex" for long-term weed control.

On all chemicals, always follow label instructions and warnings carefully

DU PONT
REG. U.S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

TELVAR® monuron · **KARMEX®** diuron

Weed Killers

Operators delay drilling this year

BY JOHN C. CASPER

DRILLING followed an abnormal seasonal pattern last year, and early reports point to another shift for 1959.

The solid bars on the right-hand chart below show the average seasonal breakdown of drilling programs for the past 5 years. The year is divided into 4-week periods, and drilling for each period is expressed as per cent of total completions for the year.

For this 5-year period, completions reported during the first 4 weeks of the year averaged 7.72% of completions for the year. Drilling for the second period averaged 7.30%; the third, 7.26%; and the fourth, 7.20%.

After the fourth period or the sixteenth week, completions started climbing and held at a high level for the last half of the year. The peak was in the eighth period with 8.06% of the total.

The 1958 drilling pattern differed from the 5-year average in that completion rates were very high at the start and at the end of the year. The compensating low rates came during the third, fourth, and fifth periods.

Completions reported for the first 4 weeks of 1958 accounted for 8.12% of total completions for the year. Except for an abnormal fifth period in 1955, January 1958 was the only first-half period above 8.0% for the past 5 years. Also, the lowest percentage for the 5-year comparison was the 5.83% shown for the fourth period of 1958.

The drilling peak for 1958 came in the last 4 weeks of the year. This period accounted for 9.20% of total completions for the year. No other 4-week period in the past 5 years has accounted for such a large portion of the year's drilling.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,211,553	UP	1,156	UP	927,650
Crude stocks	259,120,000	UP	3,860,000	DOWN	26,965,000
Completions	860	DOWN	5	DOWN	17
Refinery runs	8,207,000	DOWN	29,000	UP	709,000
Gasoline stocks	207,015,000	DOWN	729,000	DOWN	8,394,000
Kerosine stocks	18,985,000	DOWN	608,000	UP	1,363,000
Distillate stocks	80,616,000	DOWN	1,018,000	DOWN	3,402,000
Residual stocks	54,835,000	UP	253,000	UP	32,000
Four-product stocks	361,451,000	DOWN	2,102,000	DOWN	10,401,000
Total imports	2,616,800	UP	1,126,400	UP	862,900

Comparisons Could Be Misleading

Since the drilling rate was high in the early weeks of 1958, comparisons between 1959 completions and totals for the same weeks of 1958 tend to give a false picture of current drilling rates. But, measured by any standard, completions for the first 10 weeks of this year can't be called high.

Note on the chart that completions for the first two 4-week periods this year represent smaller percentages of total drilling planned by operators for 1959 than averages shown by drilling records for the past 5 years. Operators have changed either the distribution or the total for the full year.

There is a good chance that the change is in seasonal distribution. The left-hand chart shows the relationship between footage drilled and total income from oil and gas.

The points represent years. Points above the line indicate that drilling was a little high in relation to income. Points below the line show a low ratio of drilling to income. All points from 1951 through 1956 were either on or above the line. Both 1957 and 1958 were below the line. Also the forecast for 1959 places the point well below the line. Operators probably will drill the wells they had planned at the first of the year.

If drilling programs hold, a much higher percentage of completions will show up in summer and fall seasons this year.

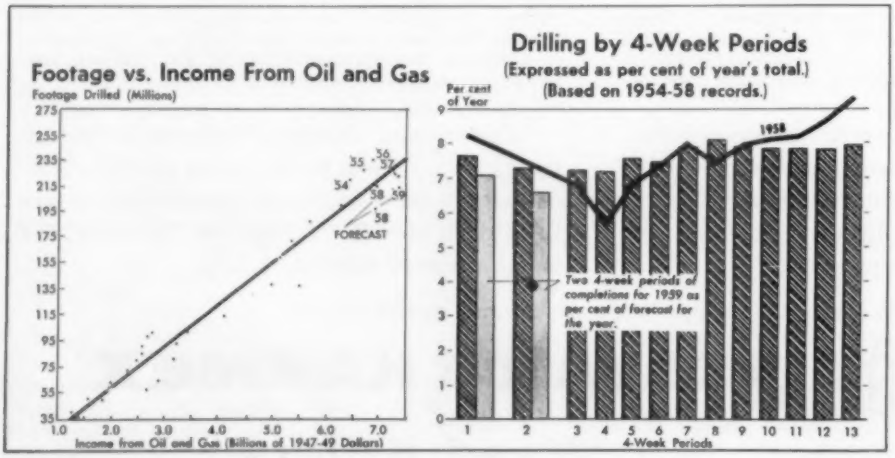
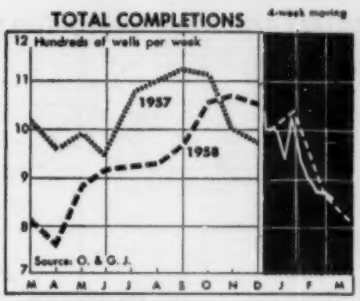


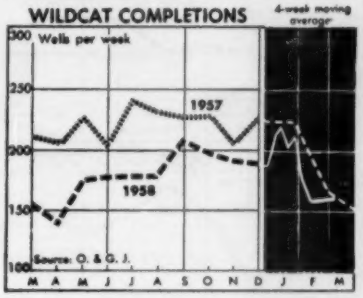
CHART on the left shows that planned drilling for 1959 is low in relation to expected income from oil and gas. Chart on the right shows seasonal patterns of completions for 1958 and for the past 5 years. Early reports for 1959 are expressed as per cent of forecast.

Active Rotary Rigs*

	3-9-59	3-2-59	3-10-58
Alabama	8	9	6
Arkansas	13	15	20
Arizona	0	0	1
California	87	85	84
Land	85	82	(†)
Offshore	2	3	(†)
Colorado	29	30	22
Florida	2	1	2
Illinois	12	14	18
Indiana	4	5	1
Iowa	3	3	0
Kansas	126	129	84
Kentucky	3	3	3
Louisiana	296	296	314
North	21	21	22
S.-Inland waters	142	137	(‡)
S.-Land	98	102	231
Offshore	35	36	61
Maryland	1	1	0
Michigan	20	17	8
Mississippi	61	51	36
Missouri	0	0	0
Montana	18	19	22
Nebraska	22	26	19
Nevada	0	0	0
New Mexico	95	99	100
New York	0	0	1
North Dakota	37	34	34
Ohio	3	3	0
Oklahoma	199	273	183
Oregon	0	0	0
Pennsylvania	13	12	12
South Dakota	1	1	0
Texas	698	705	738
S-Inland waters	8	9	(‡)
S.-Land	124	124	153
Offshore	1	1	2
North-East	147	145	(†)
West Central	252	266	(†)
West	166	160	(†)
Utah	40	38	42
Washington	0	0	1
West Virginia	4	3	4
Wyoming	52	48	42
Total U. S.	1,847	1,860	1,797
Western Canada	226	232	216
Eastern Canada	0	0	0
Grand total	2,073	2,092	2,013

*Hughes Tool Co. †Comparisons not available due to change in method of reporting. ‡Included in South-Land.



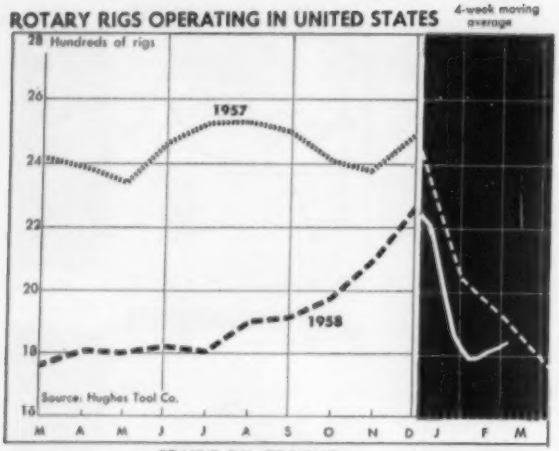


WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 7, 1959

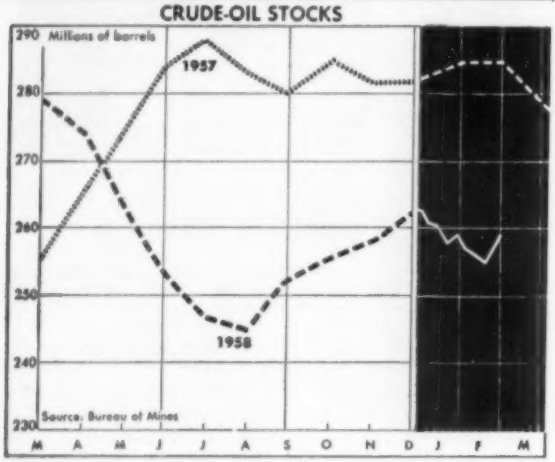
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	2	0	0	0	2	0	19,411	23	12	1	0	0	0	1	4	5
Arkansas	11	7	0	0	4	0	37,227	180	135	3	1	0	0	2	32	27
California	26	16	0	1	9	0	129,998	301	405	6	0	0	1	5	71	69
Colorado	9	1	0	2	6	0	48,751	136	141	6	1	0	0	5	71	77
Illinois	18	8	0	0	10	0	42,450	424	384	3	0	0	0	3	69	71
Indiana	5	3	0	0	2	0	9,797	125	139	3	1	0	0	2	40	48
Kansas	71	38	0	2	30	1	262,976	742	759	14	3	0	0	11	170	157
Kentucky	53	32	0	6	15	0	69,039	341	161	7	3	0	0	4	41	21
Louisiana	74	39	6	3	26	0	617,945	682	623	11	0	0	1	10	99	76
North	28	18	1	3	6	0	102,353	250	220	3	0	0	1	2	48	31
South	34	12	4	0	18	0	397,816	361	318	8	0	0	0	8	50	42
Offshore	12	9	1	0	2	0	117,776	71	85	0	0	0	0	0	1	3
Michigan	14	3	0	1	10	0	47,780	106	59	7	0	0	0	7	34	23
Mississippi	10	5	2	0	3	0	80,671	118	78	4	1	1	0	2	58	43
Montana	3	0	0	0	3	0	17,382	55	81	3	0	0	0	3	23	40
Nebraska	19	5	0	0	14	0	115,264	126	134	10	1	0	0	9	58	68
New Mexico	30	18	1	1	10	0	126,709	314	433	6	1	0	0	5	31	67
New York	22	12	0	0	3	7	34,424	74	101	3	0	0	0	3	4	9
North Dakota	5	5	0	0	0	0	31,635	80	83	0	0	0	0	0	21	31
Ohio	10	5	0	2	3	0	27,146	155	171	0	0	0	0	0	4	3
Oklahoma	108	54	2	10	38	4	335,759	1,074	1,407	14	1	0	3	10	170	194
Pennsylvania	0	0	0	0	0	0	0	59	16	0	0	0	0	0	1	1
Texas	322	187	16	9	104	6	1,478,018	3,455	3,582	50	4	1	1	44	659	767
District 1	6	2	0	0	4	0	15,827	228	181	1	0	0	0	1	59	71
District 2	13	5	3	3	2	0	88,908	142	110	4	0	1	1	2	44	30
District 3	21	6	1	0	14	0	177,286	206	239	6	0	0	0	6	61	41
District 4	16	5	3	2	6	0	92,278	246	221	6	2	0	0	4	70	74
East	21	6	3	1	11	0	115,392	211	262	5	0	0	0	5	50	76
District 7-B	45	24	0	0	21	0	153,579	431	440	6	0	0	0	6	126	139
West	109	88	3	1	17	0	545,747	1,088	1,085	10	0	0	0	10	116	166
District 9	74	39	1	1	27	6	215,786	654	780	12	2	0	0	10	107	146
District 10	17	12	2	1	2	0	73,215	249	264	0	0	0	0	0	26	24
Utah	7	5	0	0	2	0	44,162	71	84	1	0	0	0	1	18	14
West Virginia	13	3	0	8	1	1	33,654	133	141	1	0	0	1	0	5	5
Wyoming	27	9	0	1	13	4	110,670	168	160	9	0	0	1	8	66	63
Misc. (Alaska)	1	0	0	0	1	0	14,375	14	27	1	0	0	0	1	11	21
Total U. S.	860	455	27	46	309	23	3,735,243	8,956	9,316	163	17	2	8	136	1,760	1,900
Prev. week	865	441	14	68	321	21	3,399,549	.....	.....	158	24	0	8	126	.....	.....
Cum. 1959	8,956	4,523	232	596	3,372	233	37,907,005	.....	.....	1,760	189	22	65	1,484	.....	.....
Western Canada	61	32	0	11	18	0	331,712	425	452	28	5	0	5	18	162	154

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	2-28-59	2-21-59	3-1-58
Pennsylvania	2,522	2,539	2,807
Other Appalachian	1,333	1,336	1,483
Illinois, Indiana, Michigan	9,722	9,383	10,589
Nebraska and North Dakota	2,228	2,169	2,634
Kansas	8,913	9,351	9,799
Oklahoma	16,196	16,523	18,070
Arkansas	1,967	1,887	3,037
Louisiana	17,988	17,851	20,356
North	2,882	2,872	3,313
South	15,106	14,979	17,043
Mississippi, Alabama, Florida	2,366	2,254	2,638
New Mexico	9,062	8,762	8,311
Texas	115,384	113,809	130,005
East Texas	9,252	8,631	9,040
West Texas	56,183	56,011	57,255
Texas Gulf	19,964	20,500	27,457
Other Texas	29,985	28,667	36,253
Wyoming	12,776	12,632	15,487
Other Rocky Mountain	9,182	9,153	7,076
California	34,676	34,587	38,961
Foreign	†14,805	13,024	16,742
Total	**259,120**	255,260	287,995

*Bureau of Mines.. †Includes 5,135,000 bbl. in California.

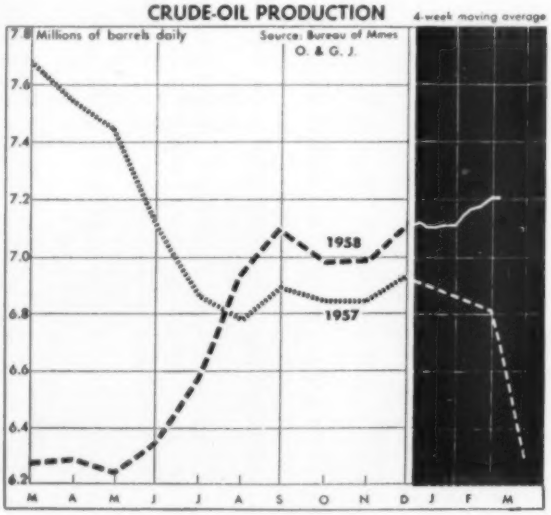
DAILY AVERAGE PRODUCTION FOR WEEK

	March 7, 1959 Crude oil	Lease condensate	Total	Feb. 28 total
Alabama	16,228	.....	16,228	15,600
Arkansas	79,525	175	79,700	79,675
California	842,000	.....	842,000	843,700
Colorado	128,700	.....	128,700	129,200
Eastern	40,200	.....	40,200	40,900
Florida	1,175	.....	1,175	1,250
Illinois	228,300	.....	228,300	225,900
Indiana	33,700	.....	33,700	33,100
Kansas	†335,600	.....	†335,600	‡330,844
Kentucky	67,000	.....	67,000	66,600
Louisiana	850,475	109,000	959,475	943,615
North	111,975	4,000	115,975	116,115
South	738,500	105,000	843,500	827,500
Michigan	22,800	.....	22,800	22,600
Mississippi	116,800	5,250	122,050	121,700
Montana	78,800	.....	78,800	79,000
Nebraska	59,600	.....	59,600	59,800
Nevada	100	.....	100	100
New Mexico	287,000	6,000	293,000	290,600
North Dakota	37,700	.....	37,700	38,000
Oklahoma	†569,600	.....	†569,600	†563,700
Texas	2,773,000	73,300	2,846,300	2,882,500
Dist. 1	43,000	3,200	46,200	45,000
Dist. 2	118,000	8,400	126,400	130,300
Dist. 3	373,000	34,400	407,000	420,000
Dist. 4	200,000	9,000	209,000	207,500
Dist. 5	32,000	400	32,400	32,500
Dist. 6	123,000	7,600	130,600	131,400
East Texas Field	159,000	.....	159,000	162,000
Dist. 7-B	145,000	150	145,150	144,150
Dist. 7-C	133,000	3,650	136,650	143,750
Dist. 8	1,134,000	3,300	1,137,300	1,148,000
Dist. 9	206,000	2,200	208,200	209,900
Dist. 10	107,000	1,000	108,000	108,000
Utah	112,500	.....	112,500	108,900
Wyoming	336,900	.....	336,900	335,100
Others	‡125	.....	‡125	‡325
Total U. S.	7,017,828	193,725	**7,211,553**	7,212,709
Change from prev. week, down			**1,156**	
Canada	†528,000	.....	†528,000	†607,163

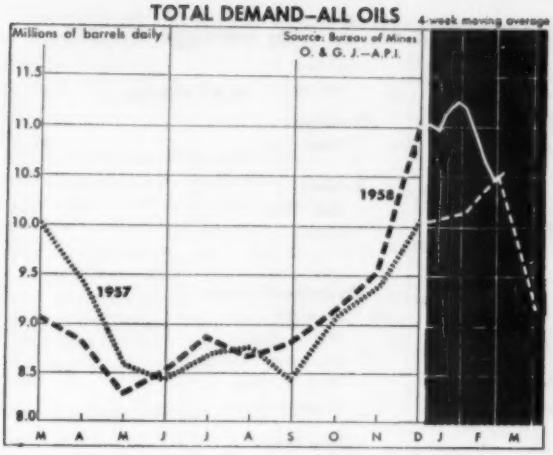
Total U. S. production—Jan. 1-March 7 ..... 472,934,230 bbl.
Same period last year (crude plus cond.) ..... *447,976,349 bbl.

*Includes 10,859,700 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Washington.

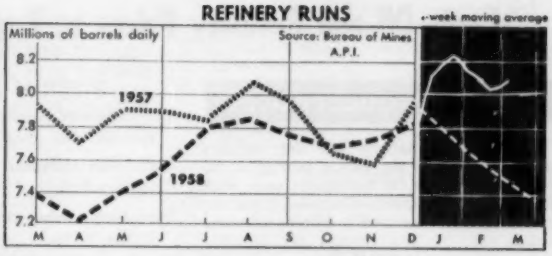
CRUDE-OIL PRODUCTION



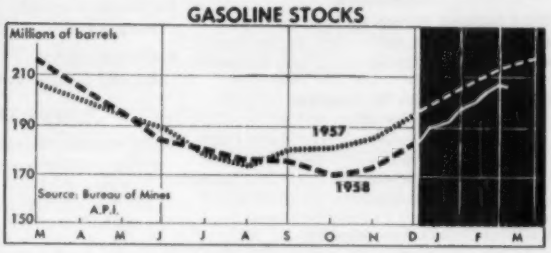
TOTAL DEMAND—ALL OILS



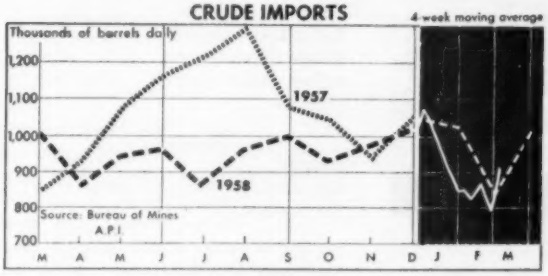
REFINERY RUNS



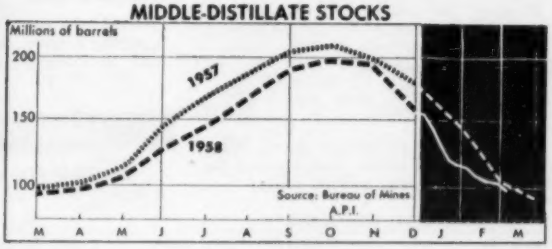
GASOLINE STOCKS



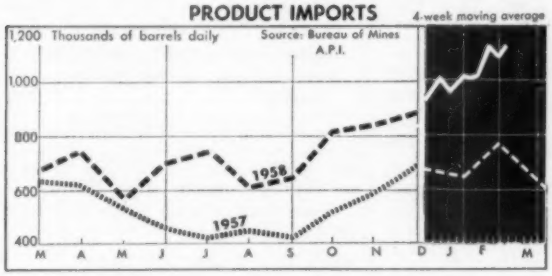
CRUDE IMPORTS



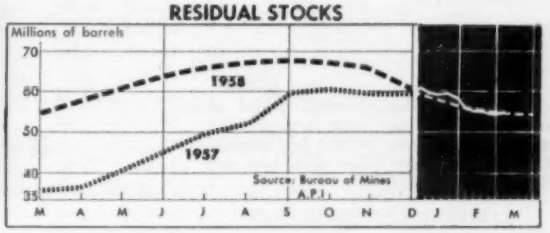
MIDDLE-DISTILLATE STOCKS



PRODUCT IMPORTS



RESIDUAL STOCKS



API REFINERY REPORT—MARCH 6, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, March 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,207	524.0	46.9	460.4	188.4	45,208	9,146	28,891	12,088	1,126.3	468.7	36.1	299.7	204.0
Appalachian:														
Dist. 1	103	42.4	4.0	24.1	12.0	4,823	428	1,878	236	92.2	39.0	5.1	23.6	9.8
Dist. 2	107	52.0	9.0	18.0	16.3	2,847	289	776	227	105.5	46.7	6.9	21.5	12.0
Ind., Ill., Ky.	1,584	729.9	73.2	402.4	202.6	36,779	3,330	11,565	3,229	1,358.2	681.0	80.1	286.9	169.1
Minn., Wis., Dak.	106	52.1	5.6	28.3	14.0	6,646	529	3,336	433	96.4	42.1	4.5	26.7	12.9
Okla., Kans., Mo.	755	405.9	13.1	208.7	31.1	21,906	844	6,574	852	627.0	340.0	13.0	160.5	30.3
Inland Texas	292	204.6	8.4	53.3	20.0	8,557	321	1,397	2,120	247.9	182.2	9.0	46.1	21.0
Texas Gulf Coast	1,815	775.1	103.3	494.6	197.1	26,704	1,514	7,963	5,257	1,715.5	813.3	108.6	437.9	184.7
La. Gulf Coast	718	380.0	63.3	187.0	60.0	12,010	1,303	3,608	1,429	600.1	335.9	59.8	133.9	45.0
N. La. and Ark.	94	43.2	5.7	22.6	5.7	5,210	659	1,500	51	101.0	46.4	6.5	21.0	8.9
Rocky Mountain:														
New Mexico	24	12.7	.1	2.6	2.9	639	37	156	18	16.8	7.3	0.2	3.4	2.8
Other Rky. Mt.	303	137.7	4.4	63.3	36.6	6,823	205	2,522	834	237.4	115.1	1.1	56.0	28.4
West Coast	1,099	563.4	4.9	192.3	284.7	28,863	380	10,450	28,061	1,032.2	467.9	5.7	132.8	286.2
Mar. 6, 1959	8,207	3,923.0	341.9	2,157.6	1,071.4	207,015	18,985	80,616	54,835	7,356.5	3,585.6	336.6	1,650.0	1,015.1
Feb. 27, 1959	8,236	3,995.1	358.7	2,181.0	1,069.0	207,744	19,593	81,634	54,582	.....	.....	.....	.....	.....
Mar. 7, 1958	7,488	3,613.4	413.7	1,733.7	1,143.0	215,409	17,622	84,018	54,803	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

★ Regular (89 octane)	11.375-11.625
★ Premium (99 octane)	14.375-14.625

Gulf Coast (cargoes for coastwise or export movements):

Regular (90 octane)	9.875-10.25
Regular (92 octane)	10.125-10.50
Premium (97 octane)	11.25-11.625
Premium (98 octane)	11.375-11.75

California (rack) (Los Angeles):

Regular (88 octane)	13.00
Premium (94 octane)	14.50-15.00
Premium (98 octane)	15.10-16.10

Caribbean area (cargoes):

Regular (87 octane)	9.875
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

★ Kerosine 42-44	10.75-11.00
★ Diesel oil (58 d.i. and above)	10.50-10.75
★ Distillate No. 1	10.50-10.75
★ Distillate No. 2	9.75-10.00

Gulf Coast (cargoes):

Kerosine 41-43	10.375
Distillate No. 2	9.875

New York Harbor (barges):

Kerosine 41-43	11.50
Distillate No. 2	11.00
Diesel fuel, 48-52 d.i.	11.25

Caribbean area (cargoes):

Distillate No. 2	9.875

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank car	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):

Residual fuel (max. 1% S)	$2.00-2.05

Gulf Coast (cargoes):

Bunker C fuel	$2.00

New York Harbor (barges):

Bunker C fuel	$2.37

Caribbean (cargoes):

Bunker C	$2.00

California (rack):

Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):

150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5

Pennsylvania Grade:

145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Another Oklahoma (sweet) schedule has a top of $3.08 with gravity variations to $2.52 for below 20°. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 12-22-58.

FLAT PRICES

Louisiana:

Sweet Lake	$3.00

Texas:

East Texas	3.25
Conroe	3.53
Van	3.08

Pennsylvania Grade:

Bradford	4.05
Middle District	3.87
Southwest Pennsylvania	3.58
West Virginia	3.40
Buckeye Grade	3.25

Illinois Basin 3.00

Canada:

Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:

Cumarebo, 48°-49.9°, Tucupido	3.51
San Joaquin, 41°-41.9°, Puerto La Cruz	3.25
Oficina, 35°-35.9°, Puerto La Cruz	2.90
Tia Juana medium, 26°-26.9°, Amuay*	2.40
Quiriquire, 16.0°-16.4°, Caripito	2.15
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.93

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):

Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05

Middle East, E. Mediterranean:

Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):

Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

Gulf-U.S.N.H., clean (USMC—25%)	$2.14
★ Gulf-U.S.N.H., dirty (ATRS —42½%)	1.64
★ Carib.-U.S.N.H., dirty (Scale—50%) (8s. 5d.)	1.18
Carib.-U.K., clean (Scale—40%) (19s. 6d.)	2.73
★ P.G.-France, dirty (USMC—70%)	3.27

(Continued from page 215)

Annual Maps Available

New maps showing oil development through 1958 have been announced by Midland Map Co., P. O. Box 1211, Midland, Tex. These special maps include:

Permian basin development map . . . Data include pools discovered prior to January 1, 1958, in blue. Discoveries and pool extensions made during 1958 are shown in red; and major basin outlines are in red. The map shows counties, county seats, producing pool outlines, and major access roads. Size 26 by 28 in., scale 1 in. to 64,000 ft.

Permian basin field map . . . This map shows producing pool outlines as of January 1, 1959, major access roads, and county seats, in blue. Major basin outlines are in red. Size 26 by 28 in., scale 1 in. to 64,000 ft., or 52 to 56 in., scale 1 in. to 32,000 ft.

Williston basin field map . . . This map covers the entire Williston basin, including its Canadian portion. Pools are outlined as of January 1, 1959. Other data include counties, county seats and major roads, plus townships and ranges. Size 26 by 28 in., scale 1 in. to 96,000 ft.; or 48 by 54 in., scale 1 in. to 48,000 ft.

Write Midland Map Co. for further details and prices.

Black Mesa map

Allstate Map Makers, formerly Austin Map Co., Majestic Building, Fort Worth, has a new Black Mesa basin regional well map for sale. This new map accurately depicts the townships and sections as surveyed through the end of 1958, showing complete information on all tests drilled to date, and the current locations of drilling tests. The present Navajo lands under lease in the northeast corner of Apache County, Arizona, show the operator and Indian tract numbers.

Williston map

Northwest Mapping Co., 117½ Fourth Street, Bismarck, N. D., has just completed a new map of the "Golden Trend" of North Dakota's Williston basin (Nesson anticline). The map shows all deep wells in the Devonian and Silurian plus all the Mission Canyon wells. Also added to the map are all field outlines according to the Industrial Commission hearing and spacing rulings. "The Golden Trend" term has been dubbed because of the gross pay of 500 ft. in the Silurian and Devonian.

Discovery wells

OKLAHOMA

Beaver County: Rip C. Underwood et al. 1 Baggerly Unit, C SE NW 21-2n-25eCM. IP 6,600 M.c.f.d., 66 BOPD, 70°, Morrow 7,572-79 ft. TD 8,150 ft. New field.

Pan American Petroleum Corp. 1 Lewis G. Pierson, SE SE NW 30-2n-25eCM. IP 744 BOPD, 39°, Morrow 7,759-61 ft. TD 8,375 ft. New field.

Harper Oil Co. 1 Miller, NW NW SE 1-3n-23eCM. IP 7,684 M.c.f.d., Morrow 7,117-45 ft. TD 7,395 ft.

Ellis County: Pan American 1 E. L. Herndon, SE NW 35-24n-24w. IP 1,744 M.c.f.d., Morrow 7,988-8,014 ft. TD 8,114 ft. Discovery 4 miles north of South Salon field.

Harper County: Sunray Mid-Continent Oil Co. 3 G. B. Crawford, C NE NW 31-26n-23w. IP 2,500 M.c.f.d., 123 BOPD, Hoover 4,352-57 ft., 4,365-70 ft.; Tonkawa 5,598-5,606 ft. TD 5,700 ft. New pay in Southeast Stockholm field.

Calvert Drilling Co. 1-A Shuman, C SW 24-28n-24w. IP 3,200 M.c.f.d., Morrow 6,164-81 ft. TD 6,315 ft. New field.

Hughes County: Bell Oil & Gas Co. 1 Lackey, C S½ SE 27-5n-11e. IP 6 M.M.c.f.d., Hartshorne 3,144-3,218 ft. TD 5,945 ft. New field.

Lincoln County: Mohawk Drilling Co. 1 Wilson-Duncan, 22-12n-6e. IP 216 BOPD, 50°, Dutcher 3,891-96 ft. TD 3,946 ft. New field.

Major County: J. M. Huber Corp. 1 Case, C SW NW 7-21n-14w. IP 521 BOPD, 41°, Cherokee sand 7,036-92 ft. TD 7,336 ft. New field 1½ miles southwest of Northeast Cheyenne Valley field.

Pittsburg County: Pure Oil Co. 1 Bauman Unit, NE NE SW 29-9n-16e. IP 3,283 M.c.f.d., Cromwell 4,368-4,455 ft. TD 5,434 ft. New extension discovery.

Pottawatomie County: Tennessee Gas Transmission Co. 1 Ernest Blumenthal "A," NE NW NE 17-11n-6e. IP 597 M.c.f.d., 57°, Hunton 4,305-25 ft. TD 4,685 ft. New field.

Stephens County: E. Alex Phillips and Eason Oil Co. 1 E. Garrett, SE SE SE 36-1n-4w. IP 25 BOPD, 29°, Eason 3,470-85 ft. TD 3,901 ft. New pay discovery.

NEBRASKA

Hitchcock County: Skelly Oil Co. 1 M. H. Lewis, SE SE SE 26-1n-32w. IP 143 BOPD, 34°, Lansing 3,862 ft. TD 4,360 ft.

ILLINOIS

Christian County: Pat Gentile 1 R. C. Williams, NW SE NE 4-14n-2w. IP 30 BOPD, Silurian 1,919-31 ft. TD 1,931 ft. Extension to Mount Auburn field.

TEXAS PANHANDLE

Hemphill County: El Paso Natural Gas Co. 1-A Mitchell, northwest part of county, 10 miles northwest of Canadian, 1 mile south of production in Sec. 136, Blk. 42, H&TC Sur. IPF 249 BOPD, 32/64-in. choke, 42°, GOR 1,349:1, lower Cherokee-Novi 9,490-9,506 ft. TD 10,360 ft. New oil discovery.

Ochiltree County: Horizon Oil & Gas Co. and Shamrock Oil & Gas Corp. 1-845 Ellis Ranch, 10½ miles southwest of Perryton, Sec. 848, Blk. 43, H&TC Sur. IP 2,750 M.c.f.d., Cleveland 6,950-70 ft.; IPF 58 BOPD, ¾-in. choke, 41.5°, Marmaton 7,162-88 ft. TD 9,130 ft. New oil and gas field.

This announcement is not an offer of securities for sale or a solicitation of an offer to buy securities.

New Issues — March 11, 1959

Colorado Interstate Gas Company

$33,000,000 First Mortgage Pipe Line Bonds, 4.70% Series due 1979

120,000 Shares Cumulative Preferred Stock, 5.35% Series

Par Value $100 per Share

Prices:

100.375% for the Bonds
plus accrued interest from March 1, 1959

$100 per share for the Preferred Stock
plus accrued dividends from date of issuance

Copies of the prospectus may be obtained from such of the undersigned (who are among the underwriters named in the prospectus) as may legally offer these securities under applicable securities laws.

Dillon, Read & Co. Inc. — Eastman Dillon, Union Securities & Co.

The First Boston Corporation — Lazard Frères & Co. — Carl M. Loeb, Rhoades & Co.

Blyth & Co., Inc. — Glore, Forgan & Co. — Goldman, Sachs & Co. — Harriman Ripley & Co. Incorporated

Kidder, Peabody & Co.* — W. C. Langley & Co. — Lehman Brothers

Merrill Lynch, Pierce, Fenner & Smith Incorporated — Smith, Barney & Co.

Stone & Webster Securities Corporation — White, Weld & Co.

*Underwriter of the Preferred Stock only.

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WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona) Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone: AXminister 2-0287.

FOR SALE EQUIPMENT

TANKS FOR SALE: 5—500 Barrel High Fives. 1—3,000 Barrel. Nolan H. Brunson, Inc., Hobbs, N. M. Phone EXpress 3-3313.

DRILLING RIG 500-3,000 ft. Double drum Cardwell and Mast Trailer mounted incl. complete drilling equip. All good condition. Priced to sell. 608 Washington, Alhambra, Calif., AT 2-8960.

1500 FAILING, 42' mast, 20' kelly, heavy duty. 71 Star $3,250.00. Bucyrus 22, $3,750.00. Fred Butler, Box 481, Pueblo, Colo.

USED PIPE AND USED TANKS—For Sale. Rogers & Wright, Incorporated, 216 West Second Street, Tulsa, Oklahoma; 710 Peoples Building, Charleston, West Virginia.

EXCELLENT 5,000' Rotary Rig Complete. Bargain Price. 15,000' 4½" Grade D & E Full Hole Extra Good Drill Pipe. Don Harman Pipe & Supply, OR 7-4343, Okla. City.

DRILLING RIG FOR SALE to highest bid, U-30 Unit Rig complete less drill pipe. Inventory list will be mailed together with bidding instructions upon request. Shell Oil Company, P. O. Box 1509, Midland, Texas, Attention: B. Hawkins.

ATTENTION—Drilling Contractors: Two steam boilers 27 H.P. skid mounted with steel housings and large water tanks. Filled with Pemberthy injectors. Both recently refiued. In first class shape—$3,000.00 each. Located Estevan, Saskatchewan, 8 miles North of United States Border. Contact Souris Servicing Company Limited, Box 1138, or call David Jacoby—ME 4-3638.

WE HANDLE all kinds of Production Equipment and have a good stock of Pumping Units for 4,000 foot to 5,000 foot wells. S. E. Frogge Equipment Co., 630 S.E. 29th Street, Oklahoma City, Oklahoma. Phones ME 2-0401, ME 4-5518, MU 5-1630.

PIPE FOR SALE

7,000' of 24" OD x ⅜" Wall 94.62# New Prime National Tube Seamless, Grade B, D.R.L., Line Pipe, located Suntide Refinery Company, Corpus Christi, Texas, mill price delivered. Direct inquiries, Box 2205, Tulsa, Oklahoma.

We Own and Offer

Compressors
5—IR XVG-6, XVG-4
1—Worth LTC-6
3—Clark RA-5, RA-3

Exchangers & Heaters
4—Petrochem ½-1¼ Mil. BTU.
10—Steel 200—3,200 sq. ft.
12—Adm. 300—2,400 sq. ft.
6—St. St. & Chr. 250—1,200 sq. ft.
3—Unused U-Tube 340—1,120 sq. ft.

Vessels & Towers

6'x36' 10 Tr. 480#	2'x45' 24 Tr.
4'x50' 12 Tr. 450#	18"x32' 15 Tr. 160#
4'x57' 10 Tr. 250#	4½'x17' 500#
8'x75' 20 Tr. 25#	12'x43' 25#
5'x96' 40 Tr. 135#	5 Pkd. Towers 12"—24"

BRILL EQUIPMENT COMPANY
4101 SAN JACINTO ST., HOUSTON 4, TEXAS, JA 6-1351
2401 THIRD AVE., NEW YORK 51, N. Y.

FOR SALE EQUIPMENT

WELL DRILLS - CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

NEW CASING Surplus 4,750 Ft. 5½" O.D. 17# N-80 Seamless Casing R-2 and 12,500 Ft. 2⅞" O.D. 6.50# N-80 Seamless Tubing R-2, located Tulsa. Midway Supply Company—Box 731, Jackson, Michigan.

FOR SALE—200,000 feet of 10¾" OD—40# —8V LW No. 1 Grade Line Pipe. T&C or PE. Lundquist Pipe & Supply Co., 325 Wright Bldg., Tulsa, Okla. Ph. LU 5-8850.

USED ENGINES

1—Waukesha GAK9U—with transmission
1—Waukesha WAK—operating condition
2—Waukesha 6WAK-31A compounded in operating condition
1—Waukesha 6WAKD Power unit less PTO—good condition
1—Waukesha 145GK with torque converter—good condition
1—Waukesha 145GK—poor condition

WESTERN MACHINERY & ENGINE CO.
320 S. Grand
St. Louis, Mo. Phone: JEfferson 1-4600

FOR SALE OR TRADE
30"
Steel Pipe

NEW LIMITED SERVICE

MILL PRESSURE TESTED ELECTRIC WELD—DRML
15,000' 30" OD x .312 WALL
30,000' 30" OD x .375 WALL

IN STOCK NOW!
Will trade for other sizes of Pipe, Casing or Tubing

WHAT HAVE YOU?

CALL—WIRE—WRITE

JOE CONWAY
VALLEY STEEL PRODUCTS CO.
124 Sidney Street
ST. LOUIS 4, MO.
Phone: PRospect 3-3020

FOR SALE EQUIPMENT

200 SECURITY 9" Tri-Cone Rock Bits at large discount. R. L. Bayless, Box 1541, Farmington, New Mexico.

RA-2 CLARK, 200 HP. RA-32 Clark, 300 hp. New spare parts. Alfred B. Kern, 305 Kennedy Bldg., Tulsa, Okla.

NEED PIPE?

8" Steel, Wt. 28 lbs., beveled for welding, straight machine cleaned, coated, strictly No. 1 grade. Pittsburgh Testing Lab. report furnished.

Indiana-Ohio Pipe Co.
P. O. Box 323 Phone 3-4674
DECATUR, INDIANA

Items For Sale

2—500 H.P. Cleaver-Brooks Oil and Gas-Fired fire tube boilers.
1—125 K.W. Buda Diesel driven generator set.
1—400 H.P. 3800 Volt Synchronous Motor with 26" x 32" Connersville Pump. Capacity 600 MCFH at 6.38 psi.
6—Ingersoll-Rand Compressors Capacity 90 MCFH driven by Cummins Diesel Engines.

Direct Inquiries to,

Milwaukee Gas Light Company
626 East Wisconsin Avenue, Milwaukee 1, Wisconsin—
Attention Mr. R. Jochimsen, Plants' Superintendent.

EQUIPMENT BARGAINS

48 **HEAT EXCHANGERS,** Steel 800—4,400 Sq. Ft. Admiralty 350—4,600 Sq. Ft. Cupro Nickel 177—5,200 Sq. Ft.
4 **BROWN FINTUBE EXCHANGERS,** 189 Sq. Ft.
6 **SUCTION HEATERS FINTUBE,** 101—1,098 Sq. Ft. New.
2 **PETROCHEM HEATERS,** 19 & 25 Million BTU.
1 **AIR HEATER,** 10,000 SCFM 100°-1200° Direct Fired.
1 **AIR BLOWER,** 11,800 CFM, 11 psi, 600 H.P. Turbine Drive.
2 **TOWERS,** 3' x 38'—8 Trays, 40 psi. 2'6" x 60'—24 Trays, 180 psi.
3 **BINS,** 6' x 10'6"—12' x 51'—12'6" x 122'.
2 **CENTRIFIX** 16" Type RVD.
1 **OTIS ELEVATOR,** 2,500#, 182' Travel
1 **REBOILER,** 165 Sq. Ft., 150 psi. shell, 300 psi. tubes.
1 **ELLIOTT BAROMETRIC CONDENSER** Type 06HB.
5 **STEAM PUMPS,** 8" x 4½" x 12"—4½" x 4" x 6"—8" x 4" x 6"
3 **CENT. PUMPS,** Vertical XP Motors 2,600 GPM at 173 Ft.—200 H.P. 1,500 GPM at 150 Ft.—125 H.P. 680 GPM at 150 Ft.— 40 H.P.
1 **PROPORTIONEERS PUMP,** 3XL, 5 H.P.

Heat & Power Co., Inc.
306 Thompson Bldg., Tulsa 3, Okla.
60 East 42nd St., New York 17, N. Y.

FOR SALE EQUIPMENT

PIPE—35,000 FT. 8⅝" surface T&C $1.35 & up per ft. Jamison Pipe & Tool Co. Ph. 80, Madison, Kansas.

CARDWELL L-350 drawworks, diesel powered, Allison torque converter, Parkersburg hydromatic brake. Two pumps, three mud tanks, shale shaker, kelly, swivel, rotary table, block and hook, drill collars and nearly complete set drilling tools and accessories. For complete inventory write McClelland Engineers, Inc., 2649 North Main. Houston, Texas.

EQUIPMENT WANTED

24L BUCYRUS-ERIE or equivalent, less tools. Box L-224, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERING SERVICE

EXPERT CORROSION Engineering Service for small operators available at reasonable cost under new plan. Inquiries invited. Rem Corporation, Box 165, Conroe, Texas.

REAL ESTATE

SHEEP RANCH FOR SALE—7600 acre Sheep Ranch in the San Luis Valley in Colorado, with summer range permit for 3,000 head. $30.00 per acre; ½ of minerals reserved. Clifford Burnham, Real Estate, Saguache, Colorado. Phone—OLympic 5-2611.

INDUSTRIAL PROPERTY for sale—Located 2 miles east of Duncan, Oklahoma: 8 room office building, warehouse with platform, garage, pipe racks, 20 acres land, 5 acres fenced. Contact The Atlantic Refining Company, Att.: J. E. Craig, Duncan, Okla., or Jim Noel, Tulsa.

HELP WANTED

RADIOACTIVITY Logging Operators with perforating experience openings in Oklahoma and Kansas. Jetwell, Inc., 932 Mayo Building, Tulsa, Oklahoma.

GEOLOGICAL EMPLOYMENT—DALLAS—Fort Worth. Timely survey of top 60 oil organizations gives present opportunities and future plans. $5.00. Earth Science Listing Service, Box 991, Dallas 21, Texas.

WILL HAVE some toolpusher FOREIGN jobs from time to time. To age 50. Seven to eight years experience. Oil Industry Employment Service, 405 Tuloma Bldg., Tulsa, Okla. GI 7-5974.

HELP WANTED

FOREIGN EMPLOYMENT: Lists about 40 U. S. oil companies, 30 drilling contractors, operating abroad, showing where apply foreign jobs. $5 cash. OIML Co. Box 2903, Tulsa, Okla.

ELECTRIC LOG SPECIALIST with geological experience for domestic employment in regional office of major oil company. Work to involve logging programs for company wells, quantitative evaluations of all types of electrical logs, and keeping up with new logging developments in industry. Salary commensurate with ability and experience. Replies will be held confidential. Box L-225, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEERS:

If you have 1 - 5 years experience in process design or manufacturing technical service—If you want the full load of responsibility and unlimited opportunity that only a small company can offer—

Write G. D. Kerns,
Technical Director,

THE VICKERS PETROLEUM CO., INC.
POTWIN, KANSAS

PETROLEUM ENGINEER

Petroleum Department of major New York financial institution has opening for a recent graduate petroleum engineer with some field work and experience in reservoir and evaluation engineering. Salary commensurate with experience.

Please reply giving full particulars on education, experience, personal data, including recent picture, references and salary expected. All replies will be confidential.

Box L-227, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION:

OVERSEAS Oil Companies, Drilling Contractors & Petroleum Personnel

The Overseas Craftsman's Association announces the establishment of a Petroleum Division exclusively designed to better coordinate employment and personnel activities for both employees and employers interested in foreign and domestic operations.

For further details write C. H. Looper, Manager Petroleum Division

Overseas Craftman's Association
428 South Spring Street, Los Angeles 13, California, or 170 Broadway, New York, N. Y.

EXPERIENCED OIL WORKERS FOR AMERICAN CONTRACTOR IN ARGENTINA

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YOUNG LAWYER, LL.B. from S.M.U., LL.M. (Taxation) from New York university. Resume available. Box L-233, The Oil and Gas Journal, Tulsa, Oklahoma.

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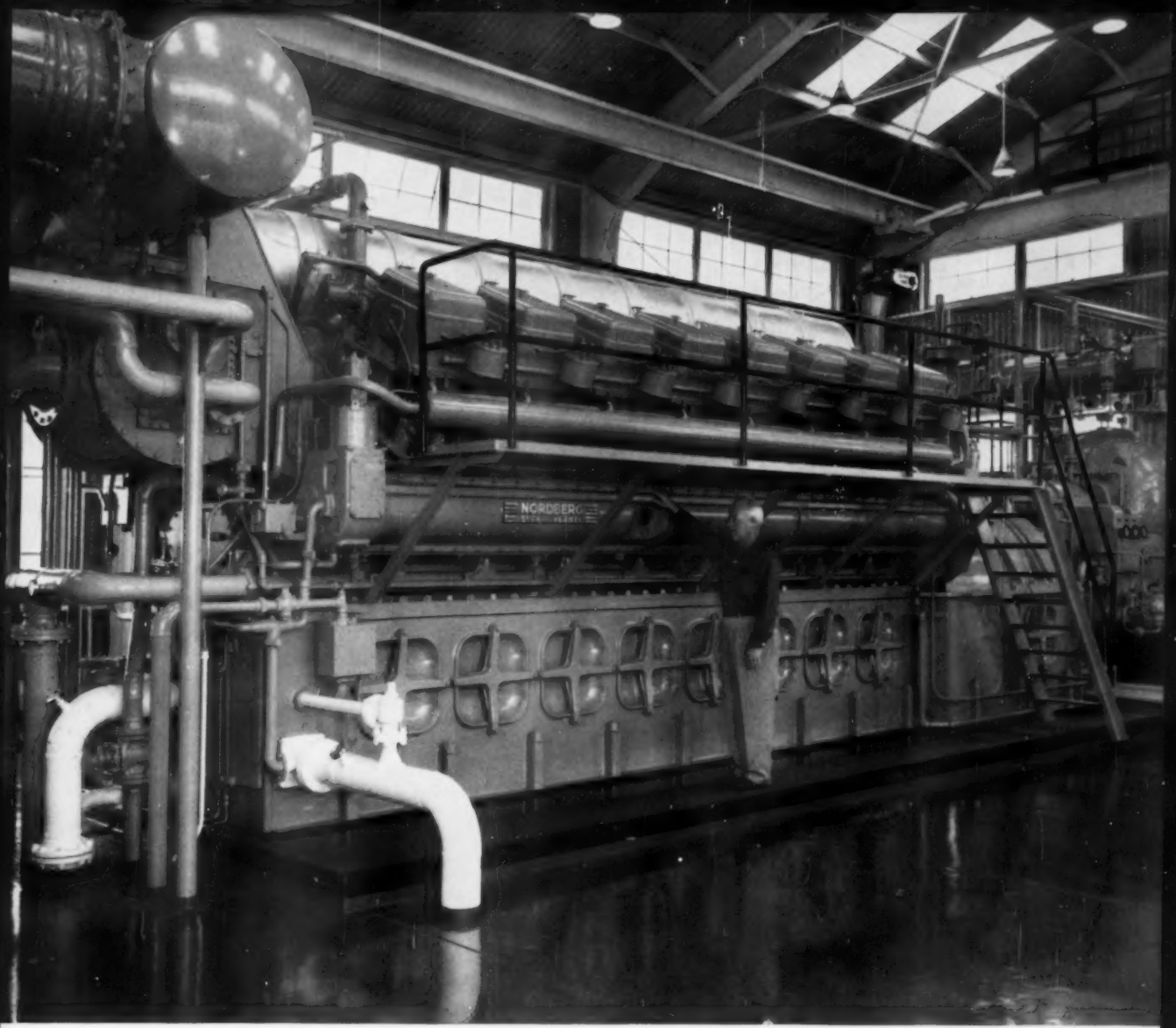

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